DESCRIPTION

Title of Invention

ELECTRONIC CIRCUIT COMPONENT MOUNTING APPARATUS

Technical Field

[0001]

The present invention relates to an electronic circuit component mounting apparatus that mounts an electronic circuit component on a circuit base member, and particularly, to an electronic circuit component mounting apparatus in which a rotary type mounting head including a plurality of adsorbing nozzles and a component feeder which are held in a rotor, moves with respect to a circuit base member holding device, and reception and mounting of an electronic circuit component from a component feeder is performed in parallel by a plurality of adsorbing nozzles.

Background Art

[0002]

In the related art, PTL 1 discloses a rotary type mounting head including a plurality of adsorbing nozzles that is held so as to move forward and backward in a plurality of positions on one circumference around a rotation axis line of a rotor. The rotary type mounting head is moved with respect to a component supply device and a circuit board holding device by a mounting head moving device. After receiving electronic circuit components from a component supply device, all the adsorbing nozzles move to the circuit board holding device, and mount the electronic circuit components on a circuit board. The plurality of adsorbing nozzles is pivoted by rotation of a rotor, and performs reception of the electronic circuit components from the component supply device and mounting of the electronic circuit components on the circuit board, in a component reception and mounting position that is one of a plurality of pivoting positions. At the time of receiving the electronic circuit components, negative pressure is supplied to the adsorbing nozzles, and at the time of mounting, supply of the negative pressure to the adsorbing nozzles is cut off and positive pressure is supplied. For this reason, a negative pressure control valve and a positive pressure control valve are provided in the rotor, with regard to each of the plurality of adsorbing nozzles. The control valves are switched by a valve switching device provided in portions corresponding to the component reception and mounting position of a head body.

Citation List

Patent Literature

[0003]

[PTL 1] JP-A-9-162597

Summary of Invention

Technical Problem

[0004]

The present invention is made in view of the above circumstances, and aims to improve practicality of an electronic circuit component mounting apparatus which includes a plurality of adsorbing nozzles and a rotary type mounting head that is moved with respect to a circuit base member holding device.

Solution to Problem

[0005]

**The above object is solved by**

“A sufficient communication between an adsorbing nozzle and the positive pressure source is allowed” described above does not mean that a slight communication is made, and means that communication is facilitated by a sufficient flow passage area in order to achieve the purpose of communication.

A circuit board includes, for example, (i) a printed wire board on which electronic circuit components are not mounted yet, (ii) a printed circuit board having one surface on which electronic circuit components are mounted and electrically connected to each other, and the other surface on which electronic circuit components are not mounted, (iii) a base member on which a bare chip is mounted and configures a board with a chip, (iv) a base member on which electronic circuit components that include ball grid arrays are mounted, (v) a base member that does not shape a flat plate and has a three-dimensional shape, or the like.

For example, a bulk feeder, a tape feeder, a stick feeder, or the like can be employed as a component feeder.

A rotor may be rotatable around a vertical axis line, and may be rotatable around an axis line that is tilted with respect to a vertical axis line. In addition, an adsorbing nozzle may be held so as to move forward and backward in a direction parallel to a rotation axis line of a rotor, by the rotor, and may be held so as to move forward and backward in an intersecting direction.

A position of the adsorbing nozzle is defined by a position of an axis line of the adsorbing nozzle.

Advantageous Effects of Invention

[0006]

In a rotary type mounting head that includes a plurality of adsorbing nozzle and a component feeder which are held in a rotor and that is moved with respect to a circuit base member holding device, one of the plurality of adsorbing nozzles is pivoted to a component mounting position that is one of a plurality of pivoting positions by rotation of the rotor, the rotary type mounting head moves with respect to the circuit base member holding device, and thereby the rotary type mounting head is located on a component mounting point of the circuit base member and mounts the electronic circuit component on the circuit base member. This technology is the same as that of a rotary type mounting head of the related art, but one adsorbing nozzle different from the plurality of adsorbing nozzles is pivoted to a component reception position, parallel to the mounting operation, and receives electronic circuit components from a component feeder. In this way, a receiving operation is performed in parallel to the mounting operation of the electronic circuit components, and thus mounting of electronic circuit components is efficiently performed.

At the time of mounting a component, positive pressure is supplied to the adsorbing nozzle, and thereby negative pressure is positively extinguished and the electronic circuit component is rapidly released. For this reason, when the adsorbing nozzle that mounts the electronic circuit component on the circuit base member is then moved to the component reception position, a negative pressure control valve enters a negative pressure source communication blocking state in which communication between the adsorbing nozzle and the negative pressure source is blocked, and a positive pressure control valve enters a positive pressure source communicable state in which the adsorbing nozzle is in a state of being communicable with the positive pressure source. At the time of receiving a component, the positive pressure control valve enters a positive pressure source communication blocking state, and the negative pressure control valve enters a negative pressure source communicable state. If switching of the positive pressure control valve and the negative pressure control valve is performed in parallel to the approach of the adsorbing nozzle in the component reception position with respect to the component feeder, the time required for receiving the component can be reduced, and mounting efficiency can be further improved. However, in this case, compressed air is blown from the adsorbing nozzle until switching of the control valve is performed, and there is risk in which the electronic circuit component that is supplied by the component feeder is blown away.

In contrast to this, after communicating with the negative pressure source in the component reception position, the adsorbing nozzle approaches the component feeder, or communication between the adsorbing nozzle and the positive pressure source is cut off. If, in a state in which an internal pressure of the adsorbing nozzle is set to atmospheric pressure, the adsorbing nozzle approaches the component feeder and communicats with the negative pressure source, there is no risk in which the component is blown away, but time required for receiving is increased.

In addition, an electromagnetic valve that integrally allows and cuts communication between all of a plurality of positive pressure control valves and the positive pressure source is provided, after all the adsorbing nozzles mounts the electronic circuit components, communication between all the positive pressure control valves and the positive pressure source is cut, while all the adsorbing nozzles receive the electronic circuit components, if positive pressure is not supplied, at the time of receiving the components, the electronic circuit components are not blown away, the adsorbing nozzle can be communicated with the negative pressure source in parallel to approaching the component feeder, but adsorbing and mounting cannot be performed in parallel.

Furthermore, an electromagnetic valve is provided with regard to each of a plurality of adsorbing nozzles, and if communication and blocking between a positive pressure source and a negative pressure source of the adsorbing nozzle is individually performed at an arbitrary time, after mounting the component, supply of positive pressure to the adsorbing nozzle is blocked before receiving the component, and the adsorbing nozzle can have atmospheric pressure. Thereby, the electronic circuit component is not blown away, the adsorbing nozzle can be communicated with the negative pressure source during approaching the component feeder, and adsorbing and mounting can be performed in parallel. However, in this case, a configuration of the rotary type mounting head is complicated and the cost is increased.

In contrast to this, in the electronic circuit component mounting apparatus according to the present invention, if the adsorbing nozzle enters a state of being located at a stop position corresponding to a second setting angle area, according to rotation of the rotor, communication with the positive pressure source is blocked. Until the positive pressure control valve enters a positive pressure source communicable state, communication between the adsorbing nozzle and the positive pressure source is blocked, and at the time of receiving the component, the adsorbing nozzle can approach the component feeder in a state in which positive pressure is not supplied. Thus, while approaching the component feeder of the adsorbing nozzle, even if the negative pressure control valve is switched from a negative pressure source communication blocking state to a negative pressure communicable state, the adsorbing nozzle can adsorb the electronic circuit component without blowing. Meanwhile, communication with the positive pressure source is allowed with regard to the adsorbing nozzle that is located at a component mounting position that is a stop position corresponding to the first setting angle area, and thereby positive pressure is supplied, and the electronic circuit component is rapidly released.

In this way, according to the present invention, a nozzle and positive pressure source communicating and blocking section is provided in the rotary type mounting head, and thereby even if an electromagnetic valve is not provided with regard to each of the plurality of adsorbing nozzles, communication with the positive pressure source can be mechanically blocked before the adsorbing nozzle reaches the component reception position, the electronic circuit component is not blown, switching of the control valve can be performed while approaching the component feeder, receiving and mounting of the components can be performed in parallel, the electronic circuit component can be rapidly released by supplying positive pressure to the adsorbing nozzle in the component mounting position. According to this, mounting efficiency is increased, and an electronic circuit component mounting machine with an inexpensive configuration and a simple configuration is obtained.

[0007]

In the electronic circuit component mounting machine according to the present invention, it is preferable that a plurality of radial passages is formed in the rotor in a state of extending in a radial shape from a central hole of the rotor to a plurality of positions corresponding to each of the plurality of adsorbing nozzles, and the nozzle and positive pressure source communicating and blocking section includes (a) a communication control section having a cutout section that is relatively and rotatably fit to the central hole, and sets radial passages corresponding to one or more adsorbing nozzles at a stop position corresponding to the first setting angle area, among the plurality of radial passages, to a fully open state, according to rotation of the rotor, and having a closing section that sets radial passages corresponding to one or more adsorbing nozzles at a stop position corresponding to the second setting angle area, to a fully closed state; and (b) a positive pressure source communication passage that makes the cutout section communicate with the positive pressure source, regardless of a rotation position of the rotor.

In the electronic circuit component mounting apparatus of the preferable aspect, a first setting angle area is set by taking into account communication between the radial passage and the cutout section. The cutout section is configured to have a shape that allows communication with the entire opening on a central hole side of at least one radial passage, and dimension, around a rotation axis line of the rotor and in a direction parallel to the rotation axis line. When the radial passage pivots toward the cutout section according to rotation of the rotor, a communication area with respect to the cutout section of an opening on the central hole side is gradually increased, and the entire opening enters a state of being located inside the cutout section. In addition, when the radial passage is separated from the cutout section according to the rotation of the rotor, a communication area with respect to the cutout section of the opening is gradually decreased, and entirety is in a state of deviating from the cutout section. If a corresponding radial passage starts to communicate with the cutout section even at a portion, the adsorbing nozzle communicats with a positive pressure source, and while the corresponding radial passage starts to communicate with the cutout section even at a portion, it can be said that the adsorbing nozzle communicats with the positive pressure source, but even if, in this state, the positive pressure control valve is in a state in which the adsorbing nozzle can be communicated with the positive pressure source, rapid supply of positive pressure is not preferable. Thus, the first setting angle area is set to an angle area in which the entire opening on the central hole side of the radial passage corresponding to one or more adsorbing nozzles located at a stop position corresponding to the angle area is located inside the cutout section is guaranteed.

In addition, when an opening on a central hole side of a radial passage corresponding to one or more adsorbing nozzles located on a stop position corresponding to the angle area is fully closed by a closing section, and a negative pressure control valve makes an adsorbing nozzle that is pivoted to the vicinity of a component reception position communicate with a negative pressure source, the second setting angle area is set to an angle area in which supply of positive pressure is completely blocked is guaranteed.

In this way, a cutout section of a communication control section may be able to guarantee that a radial passage corresponding to the adsorbing nozzle is in a fully open state, in a state in which at least one of a plurality of adsorbing nozzles reaches the vicinity of a component mounting position, and the closing section may be able to guarantee that a radial passage corresponding to the adsorbing nozzle is in a fully closed state, in a state in which at least one of a plurality of adsorbing nozzles reaches the vicinity of a component reception position. In a state in which a plurality of adsorbing nozzles is located at other pivoting positions, an opening on a central hole side of a radial passage corresponding to the adsorbing nozzle may be open, and may be closed.

Here, it is further preferable that, in a state in which one of the plurality of adsorbing nozzles is located at the component mounting position, the cutout section of the communication control section sets a plurality of radial passages corresponding to at least one of the adsorbing nozzles and one or more of the adsorbing nozzles located on an upstream side in a rotation direction of the rotor higher than the one adsorbing nozzle, to a fully open state. In addition, it is further preferable that, in a state in which one of the plurality of adsorbing nozzles is located at the component mounting position, the closing section of the communication control section sets a plurality of radial passages corresponding to at least the one adsorbing nozzle and one or more adsorbing nozzles located on an upstream side in a rotation direction of the rotor higher than the one adsorbing nozzle, to a fully closed state.

In this way, if a plurality of radial passages corresponding to one adsorbing nozzle located at a component mounting position and one or more adsorbing nozzles located on an upstream side in a rotation direction of a rotor higher than the one adsorbing nozzle, is in a fully open state, when switching of a positive pressure control valve is performed in parallel to the approach of an adsorbing nozzle with respect to a component mounting position, supply of positive pressure to an adsorbing nozzle is rapidly performed can be guaranteed.

In addition, if a plurality of radial passages corresponding to one adsorbing nozzle located at a component reception position and one or more adsorbing nozzles located on an upstream side in a rotation direction of a rotor higher than the one adsorbing nozzle, is in a fully closed state, when switching of a negative pressure control valve is performed in parallel to approaching of an adsorbing nozzle with respect to a component reception position, supply of positive pressure to an adsorbing nozzle can be completely blocked, and supply of negative pressure rapidly performed can be guaranteed.

Brief Description of Drawings

[0009]

Fig. 1 is a perspective view illustrating a portion of an electronic circuit component mounting line including a plurality of mounting modules serving as an electronic circuit component mounting machine that is an embodiment of the present invention.

Fig. 2 is a perspective view illustrating a rotary type mounting head and a mounting head moving device of the mounting module.

Fig. 3 is a perspective view illustrating the mounting head.

Fig. 4 is a perspective view illustrating a component mounting position vicinity section of the mounting head.

Fig. 5 is a perspective view illustrating a component receiving position vicinity section of the mounting head.

Fig. 6 is a side sectional view schematically illustrating the mounting head.

Fig. 7 is a diagram illustrating a pivoting position of a plurality of adsorbing nozzles of the mounting head.

Fig. 8 is a side view illustrating a base plate of a bulk feeder and a component case of the mounting head.

Fig. 9 is a side view illustrating the bulk feeder.

Fig. 10 is a section plan view illustrating a first radial passage provided in a rotor of the mounting head, and a cutout section of a communication control section provided in a head body.

Fig. 11 is a section plan view illustrating a second radial passage provided in the rotor.

Fig. 12 is a perspective view illustrating the communication control unit.

Fig. 13 is a block diagram conceptually illustrating a control device or the like of the mounting module.

Fig. 14 is a view illustrating supply of positive pressure that is allowed by the cutout section.

Description of Embodiments

[0010]

Hereinafter, embodiments of the present invention will be described with reference to the drawings. The present invention can be implemented in a manner that is subjected to various modifications based on the knowledge of those skilled in the art, in addition to the following embodiments.

[0011]

A plurality of mounting modules 10 serving as an electronic circuit component mounting machine that is an embodiment of the present invention is illustrated in Fig. 1. The mounting modules 10 are arranged in a row in a manner making them adjacent to each other on a common base which is an integral base 12, are fixed, and configure a mounting line. The mounting module 10 is described in detail, for example, in JP-A-2004-104075, and portions other than the portions related to the present invention will be briefly described. Hereinafter, an electronic circuit component is referred to as a component.

[0012]

In the present embodiment, each mounting module 10 respectively includes a module body 18 that is a body of a component mounting machine, a circuit board transport device 20, a circuit board holding device 22, a component supply device 24, a the rotary type mounting head 26 (hereinafter, referred to as a mounting head 26), a the mounting head moving device 28, a reference mark imaging device 30 (refer to Fig. 2), a component imaging device 32, and a module control device 34.

[0013]

In the present embodiment, the circuit board transport device 20 includes two board conveyors 40 and 42, and transports a circuit board 44 (hereinafter, referred to as a board 44) that is a type of a circuit board, in a horizontal direction that is parallel to a direction in which the plurality of mounting modules 10 is lined up. In the present embodiment, a “circuit board” will be used as a generic name of a printed wire board and a printed circuit board. The circuit board holding device 22 is provided in each of the two board conveyors 40 and 42 of the module body 18, respectively includes supporting members that support the board 44 from below, and clamp members that respectively clamp both side edges parallel to a transport direction of the board 44, and holds the board 44 in a posture where a component mounting surface on which components of the board 44 are mounted is horizontal. In the present embodiment, a direction in which the board 44 is transported by the circuit board transport device 20 is referred to as an X-axis direction, and a direction which is orthogonal to the X-axis direction in a horizontal surface that is one plane parallel to the component mounting surface of the board 44 held in the circuit board holding device 22 is referred to as a Y-axis direction. The component supply device 24 supplies components using a plurality of tape feeders 50 that is an alignment component feeder in the present embodiment, and is provided so as to be fixed to a base plate 52 of the module body 18.

[0014]

The mounting head moving device 28 includes an X-axis direction moving device 60 and a Y-axis direction moving device 62 as illustrated in Fig. 2. The Y-axis direction moving device 62 includes a linear motor 64 that is provided across a component supply section of the component supply device 24 and the two circuit board holding devices 22, in the module body 18, and moves a Y-axis slide 66 serving as a moving member that is a movable member to an arbitrary position in the Y-axis direction. The X-axis direction moving device 60 is provided in the Y-axis slide 66, moves in the X-axis with respect to the Y-axis slide 66, and includes two X-axis slides 70 and 72 serving as moving members that are movable members, and an X-axis slide moving device 74 (X-axis slide moving device that moves the X-axis slide 72 is illustrated in Fig. 2) that moves the respective X-axis slides 70 and 72 in the X-axis direction.

[0015]

A two-X-axis-slide moving device includes, for example, an electric motor 76 that is a drive source, and a feeding screw mechanism 78 including a screw shaft and a nut, moves the S-axis slides 70 and 72 to an arbitrary position in the X-axis direction, and the X-axis slide 72 moves to an arbitrary position in a horizontal movement plane, so as to illustrate the X-axis slide moving device 74. The electric motor 76 is configured by a servo motor with an encoder, in the present embodiment. The servo motor is an electric rotary motor which can perform the correct control of a rotary angle, and instead of the servo motor, a step motor or a linear motor may be used. In addition, a ball screw mechanism is suitable for the feeding screw mechanism. Other electric motors and feeding screw mechanisms which will be described below are the same as above. A head moving device may be assumed that a Y-axis direction moving device is provided on an X-axis slide. The mounting head 26 is detachably mounted on the X-axis slide 72, moves with respect to the circuit board holding device 22 according to the movement of the X-axis slide 72, and moves to an arbitrary position in a head movement area that is a movement area across a component supply section of the component supply device 24 and the two circuit board holding devices 22.

[0016]

The reference mark imaging device 30 is mounted in the X-axis slide 72, is moved together with the mounting head 26 by the mounting head moving device 28, and images a reference mark (not illustrated) provided in the board 44, as illustrated in Fig. 2. In addition, the component imaging device 32 is provided so as to fix a position in a portion between the circuit board transport device 20 and the component supply device 24 of the base plate 52, as illustrated in Fig. 1, and images a component that is an imaging target from below.

[0017]

The mounting head 26 will be described. The mounting head 26 is described in detail in the respective specifications of Japanese Patent Application No. 2011-206452 and PCT/JP2012/074105 with regard to application of the present applicant, which are not published yet, and portions other than the portions related to the present invention will be briefly described.

[0018]

The mounting head 26 includes a plurality of adsorbing nozzles 90, as illustrated in Fig. 3. The plurality of adsorbing nozzles 90 is held by a rotor 92. The rotor 92 includes a shaft section 94 and a nozzle holding section 96, as schematically illustrated in Fig. 6. Both end portions of the shaft section 94 are rotatably held by a head body 98 via bearings 100 and 102 in a posture in which an axis line of the shaft section 94 are vertical, and the rotor 92 is rotated by a rotor rotation device 104 around a vertical axis line in both forward and reverse directions at an arbitrary angle. The rotor rotation device 104 uses an electric motor 106 (refer to Fig. 3) provided in the head body 98 as a drive source, and rotation of the electric motor 106 is transferred to the rotor 92 by gears 108 and 110.

[0019]

The nozzle holding section 96 has a larger diameter than the shaft section 94, a plurality of nozzle holders 120, which is preferably three or more nozzle holders and is twelve nozzle holders in the present embodiment, is provided, and a maximum of twelve of the adsorbing nozzles 90 are held by the rotor 92. Twelve of the nozzle holders 120 are respectively fit so as to move forward and backward in an axis direction at a plurality of positions separated at appropriate intervals on one circumference around a rotation axis line of the rotor 92 of the outer periphery of the nozzle holding section 96, at twelve positions with an equal angular interval in the present embodiment, in a posture in which the axis direction is parallel to a rotation axis line of the rotor 92, so as to move upward and downward in the present embodiment, and are rotatably fit around an axis line of the holder. The nozzle holders 120 hold the adsorbing nozzles 90.

[0020]

The rotor 92 performs intermittent rotation at an angle equal to an arrangement angle interval of the nozzle holder 120, the twelve adsorbing nozzles 90 are pivoted around the rotation axis line of the rotor 92, and sequentially stop at each of twelve pivoting positions that are set so as to be separated at an equal angle. In addition, as illustrated in Fig. 3, the nozzle holders 120 are pressed upward by a compression coil spring 122, and a roller 124 that is a cam follower which is provided on an upper portion of the nozzle holder 120 moves along a cam surface 128 of a cam 126 that is provided in the head body 98 so as to be fixed. Thereby, the adsorbing nozzles 90 are pivoted around the rotation axis line of the rotor 92 and are lifted.

[0021]

For this reason, all distances in a height direction from the circuit board holding device 22 of the adsorbing nozzles 90 at twelve pivoting positions to a stop position are not equal, a pivoting position with the shortest distance in a height direction becomes a component mounting position in which mounting of a component to the board 44 is performed, and a position that is separated by 180 degrees from the component mounting position, in the most long and high pivoting position becomes a component imaging position. In addition, as illustrated in Fig. 7, if the component mounting position is set to a first pivoting position, a fifth pivoting position that is a fifth pivoting position in a rotation direction (direction illustrated by a solid line in Fig. 7) of the rotor 92 at the time of mounting of component to the board 44, becomes a component receiving position in which a component is received from a bulk feeder that will be described later. Out-take of a component from the tape feeder 50 by the adsorbing nozzles 90, and mounting to the board 44 of a component that is taken out from the tape feeder 50 and a bulk feeder are all performed at a component mounting position, and the component mounting position is also a component receiving device position. In Fig. 6, the spring 122, the roller 124, and the cam 126 are not illustrated. Alternatively, the compression coil spring 122 is a type of spring which is used as an elastic member that is a type of lifting device. Other coil springs that will be described below are also the same as above.

[0022]

In addition, as illustrated in Fig. 3, a nozzle rotation drive device 140 is provided in the head body 98, the nozzle holder 120 is rotated around an axis line of the nozzle holder 120, and the adsorbing nozzles 90 rotate. The nozzle rotation drive device 140 uses an electric motor 142 as a drive source. As illustrated in Fig. 6, rotation of the electric motor 142 is transferred to the twelve nozzle holders 120 by a gear 144 attached to each of twelve nozzle holders 120 and common gears 146, 147, and 148, and all twelve of the adsorbing nozzles 90 rotate at the same time.

[0023]

As illustrated in Fig. 3 and Fig. 5, nozzle lifting devices 150 and 152 that are nozzle advancing and retreating devices are respectively provided in a portion corresponding to a component mounting position and a component reception position of the head body 98. The nozzle lifting device 150 at the component mounting position includes a lifting member 154, a feeding screw mechanism 156, and an electric motor 158, as illustrated in Fig. 3. The feeding screw mechanism 156 includes a feeding screw 160 and a nut 162. The lifting member 154 is fixed to the nut 162, as illustrated in Fig. 4, a roller 164 that is a rotation engaging member on the rotor 92 side of the lifting member 154 is rotatably attached to an axis line orthogonal to a rotation axis line of the rotor 92, and configures an engaging unit. The feeding screw 160 is rotated by the electric motor 158, and thereby the lifting member 154 is guided to a guide rod 166 (refer to Fig. 3) configuring a guiding device, and moves to an arbitrary position in a vertical direction.

[0024]

In accordance with the descent of the lifting member 154, the roller 164 is in contact with an upper surface of an engaged section 168 (refer to Fig. 4) of a plate shape provided in the nozzle holder 120, presses down the nozzle holder 120 against a pressing force of the compression coil spring 122, and allows the adsorbing nozzles 90 to descend. By the ascent of the lifting member 154, the plurality of nozzle holders 120 is allowed to ascend by a pressing force of the compression coil spring 122, and the plurality of adsorbing nozzles 90 ascends. The nozzle lifting device 150 is a device having a configuration in which the adsorbing nozzles 90 forcibly descend, and allows to ascend.

[0025]

A nozzle lifting device 152 in a component reception position is configured in the same manner as the nozzle lifting device 150, and as illustrated in Fig. 5, includes a lifting member 172, a feeding screw mechanism 178 including a feeding screw 174 and a nut 176, and an electric motor 180 (refer to Fig. 3). A roller (not illustrated) is rotatably attached to the lifting member 172, and thereby configures an engaging unit. A nozzle lifting device may be configured by a device that forcibly moves the adsorbing nozzles 90 together in ascending and descending motion.

[0026]

As illustrated in Fig. 3, a component imaging device 190 is provided in a component imaging position. A camera 192 of the component imaging device 190 images the tape feeder 50 by the component imaging device 190 or a component taken out from the following bulk feeder by the adsorbing nozzle 90, via a reflection device (not illustrated).

[0027]

As illustrated in Fig. 5, a bulk feeder 200 that is a type of a component feeder is provided in a portion corresponding to the component reception position of the head body 98, and moves together with the adsorbing nozzle 90 or the like by the mounting head moving device 28. The component supply device 24 is a mounting machine body side component supply device that is provided in a fixed manner on the base plate 52 of the module body 18, the tape feeder 50 that configures the component supply device 24 is a mounting machine body side feeder, the bulk feeder 200 is a head side feeder provided in the mounting head 26, and these devices configure the component supply device of the mounting module 10. As illustrated in Fig. 8 and Fig. 9, the bulk feeder 200 includes a base plate 208, a component case 210, and a component feeding device 212. An accommodation chamber 214, a guide groove 216, a guide passage 218, and a concave section 220 are provided in the component case 210. A plurality of components 222 are contained in the accommodation chamber 214 as bulk components in a bulk carrier state. A leadless electronic circuit component having no lead, for example, a component (chip component) having an electrode formed of a magnetic material such as a capacitor or a resistor, is contained as the component 222.

[0028]

The component feeding device 212 includes a bulk component drive device 230 illustrated in Fig. 9. The bulk component drive device 230 is provided in the head body 98, and includes a rotation disk 234 and a rotation disk drive device 236. The rotation disk 234 is accommodated in a concave section 220 of the component case 210, and a plurality of permanent magnets 238, for example, three or more permanent magnets are held on a side surface of the rotation disk 234. The rotation disk drive device 236 uses an electric motor 240 as a drive source, rotation of the rotation disk drive device 236 is transferred to the rotation disk 234 by gears 242, 244, and 246, and the rotation disk drive device 236 rotates the rotation disk 234 in both forward and reverse directions in an arbitrary angle. Thereby, components 222 in the accommodation chamber 214 are sucked by a permanent magnet 238 thereby moving from below to above, a portion is introduced into the guide groove 216, enters the guide passage 218 from the guide groove 216, and moves in a state of being aligned in a row. The components 222 eventually enter a guide passage 248 (refer to Fig. 5) provided on the base plate 208, and move to a component supply section 250 (refer to Fig. 5). The guide passage 248 extends out from the component case 210 to a position located on a lower side of the adsorbing nozzle 90 located at a component reception position, and this portion configures the component supply section 250. Air in the guide passage 248 is sucked by an air suction device (not illustrated), and movement to the component supply section 250 of the components 222 is promoted. Movement of the components 222 is stopped by a stopper (not illustrated) provided on the base plate 208, and a head component 222 is positioned in the component supply section 250. In the present embodiment, the component case 210 configures a component accommodation section, the guide groove 216, the guide passages 218 and 248, the bulk component drive device 230, and the air suction device configures the component feeding device 212, and configures a component feeding section that aligns the components in the component accommodation section in the guide passage in a row and feeds to the component supply section.

[0029]

As illustrated in Fig. 4, control valve devices 280 corresponding to each of the twelve nozzle holders 120 are provided in the nozzle holding section 96 of the rotor 92, and control the supply of positive pressure and negative pressure to the adsorbing nozzles 90. In the present embodiment, the control valve device 280 is configured by a spool valve 282, and the spool valve 282 is rotatably introduced into a spool hole 284 formed in the nozzle holding section 96 in a direction parallel to the rotation axis line of the rotor 92, as schematically illustrated in Fig. 6. A switching section 285 with a small diameter of the valve spool 282 communicats with the adsorbing nozzle 90 by a passage 286 formed in the nozzle holding section 96, and a passage 288 formed in the nozzle holder 120. As illustrated in Fig. 6, it is assumed that the present control valve device 280 enters a positive pressure source communication blocking state in which communication with a positive pressure source 290 of the adsorbing nozzle 90 is blocked, and a negative pressure source communicable state in which the adsorbing nozzle 90 is communicable with the negative pressure source 292, from a positive pressure source communicable state in which the adsorbing nozzle 90 is communicable with the positive pressure source 290, and a negative pressure source communication blocking state in which communication with a negative pressure source 292 of the adsorbing nozzle 90 is blocked, according to the valve spool 282 that descends, and enters reverse states according to the valve spool 282 that ascends. The control valve device 280 configures a negative pressure control valve and a positive pressure control valve, and the negative pressure control valve and the positive pressure control valve are integrally formed in the present embodiment. Alternatively, the negative pressure control valve and the positive pressure control valve may be provided separately.

[0030]

As illustrated in Fig. 6, a central hole 300 that uses an axis line as a center line is formed in the rotor 92. An end of the central hole 300 is opened in an upper surface of the shaft section 94, the other end of the central hole 300 is formed by a bottomed via hole leading to the inside of the nozzle holding section 96, and a supporting shaft 302 is concentrically disposed inside the central hole 300. An upper end of the supporting shaft 302 is fixed to the head body 98, bearings 304 and 306 are provided between both of the upper and lower ends and the rotor 92, and although the supporting shaft 302 and the rotor 92 are supported to each other, the supporting shaft 302 does not rotate regardless of the rotation of the rotor 92.

[0031]

A diameter of the supporting shaft 302 is smaller than a diameter of the central hole 300, but a communication control section 310 with a diameter that is introduced exactly, relatively, and rotatably to the central hole 300 is integrally provided in a portion adjacent to an upper side of a portion in which the bearing 306 is provided, in the lower end portion of the supporting shaft 302. Thereby, in the inside of the central hole 300, an annular passage 312 is formed on an upper side of the communication control section 310, and on a lower side of the communication control section 310, a communication chamber 314 is formed between the supporting shaft 302 and a bottom surface of the central hole 300. The passage 312 communicats with a positive pressure source 290 by a board 320 formed in the shaft section 94, an annular passage 322 provided in the head body 98, a passage 324 communicated in the passage 322, or the like. In addition, the communication chamber 314 communicats with a negative pressure source 292 by a passage 330 formed in the bearing 94, and a passage 332 formed in the head body 98.

[0032]

As illustrated in Fig. 6, in a portion corresponding to the communication control section 310 of the nozzle holding section 96, a plurality of radial passages 350, which are twelve radial passages 350 as illustrated in Fig. 10 in the present embodiment, is formed in a state of extending out in a radial shape from the central hole 300, and configures a first radial passage. Hereinafter, the radial passages 350 are referred to as a plurality of first radial passages 350. Each sectional shape of the twelve first radial passages 350 has a circular shape, each of the twelve first radial passages 350 is orthogonal to each of the twelve spool holes 284, and extends out in an equal angular interval at twelve positions corresponding to each of the twelve adsorbing nozzles 90. The control valve devices 280 provided in the corresponding adsorbing nozzles 90 enter a positive pressure source communicable state, and thereby the twelve first radial passages 350 are respectively communicated to the adsorbing nozzles 90 via the switching section 285, and the passages 286 and 288.

[0033]

In addition, in the nozzle holding section 96, a plurality of radial passages 352, which are twelve radial passages as illustrated in Fig. 11 in the present embodiment, is formed in a state of extending outward in a radial manner from the communication chamber 314 as illustrated in Fig. 6, and the radial passages 352 configure a second radial passage. Hereinafter, the radial passages 352 are referred to as the second radial passage. Each sectional shape of the twelve second radial passages 352 has a circular shape, each of the twelve second radial passages 352 is located on a side lower than the first radial passage 350, is formed in a portion separated in a parallel direction to the rotation axis line of the rotor 92, is orthogonal to each of the twelve spool holes 284, and extends outward in an equal angular interval at positions corresponding to each of the twelve adsorbing nozzles 90 from a central portion of the rotor 92. The twelve second radial passages 352 are communicated to the negative pressure source 292 via the communication chamber 314 regardless of the rotational position of the rotor 92. In the present embodiment, the communication chamber 314 and a passage 330 configure a negative pressure source communication passage. The control valve devices 280 provided in the corresponding adsorbing nozzles 90 enter a negative pressure source communicable state, and thereby the twelve second radial passages 352 are respectively communicated to the adsorbing nozzles 90 via the switching section 285, and the passages 286 and 288.

[0034]

As illustrated in Fig. 12, in a portion in an axis direction of the outer circumference of the communication control section 310, a portion of the portions corresponding to the portions in which the first radial passages 350 of the nozzle holding section 96 in an axis direction are formed does not include the axis line of the supporting shaft 302, is cut in a plane parallel to the axis line of the supporting shaft 302, and a cutout section 360 in which a sectional shape of an opening of an outer circumferential surface of the communication control section 310 is an arch is formed. A dimension of the cutout section 360 in a direction parallel to the axis direction of the communication control section 310 is greater than a diameter of the first radial passage 350. The cutout section 360 communicats with the passage 312 (refer to Fig. 6) by a passage 362 formed in a portion in which the cutout section 360 of the communication control section 310 is defined. Thereby, the cutout section 360 communicats with the positive pressure source 290 by a passage 312, the board 320, and the passages 322 and 324. The passage 312 has a circular shape, and the cutout section 360 communicats with the positive pressure source 290, regardless of the rotational position of the rotor 92. In the present embodiment, the passage 312 configures a positive pressure source communication passage. The positive pressure source communication passage and the negative pressure source communication passage configured by the communication chamber 314 and the passage 330 extend in directions opposite to each other and parallel to the rotation axis line of the rotor 92, from positions in which the first radial passage 350 and the second radial passage 352 are respectively communicated. In the present embodiment, the positive pressure source communication passage extends upwards, and the negative pressure source communication passage extends downwards. For this reason, it is possible to configure a rotor with a small diameter, compared to a case in which the two communication passages are provided side by side in a direction orthogonal to the rotation axis line of the rotor. In addition, it is possible to make a connection between the positive pressure source communication passage and the positive pressure source 290, and a connection between the negative pressure source communication passage and the negative pressure source 292, at positions different from each other. It is possible to avoid complicating the configuration of the mounting head 26.

[0035]

The rotor 92 rotates around the communication control section 310 that is provided in the supporting shaft 302 and is fixed to the head body 98, and the twelve first radial passages 350 rotate with the cutout section 360. For this reason, among the twelve first radial passages 350, only the first radial passage 350 that is in a state of being located at a position corresponding to the cutout section 360 communicats with the cutout section 360, and the first radial passage 350 deviated from the cutout section 360 is not communicated to the cutout section 360. In the present embodiment, as illustrated in Fig. 10, the cutout section 360 is formed as a cutout having an arch sectional shape defined by a chord and a circumference which correspond to a central angle of 120 degrees of the rotor 92. For this reason, an opening on a center side of the rotor 92 of the first radial passage 350 can face entirely the cutout section 360, one first radial passage 350 corresponding to the adsorbing nozzle 90 at a component mounting position and the first radial passages 350 on both sides of the one first radial passage 350 enter a fully open state, in a state in which the rotor 92 stops rotation at a position illustrated in Fig. 10, and furthermore, openings on center sides of the rotors of the first radial passages 350 located on the both sides enter a state of being half closed by the communication control section 310.

[0036]

The above description that is “one first radial passage 350 corresponding to the adsorbing nozzle 90 at a component mounting position and the first radial passages 350 on both sides of the one first radial passage 350 enter a fully open state” does not mean that an opening on the center side of the rotor of the first radial passage 350 simply enters a fully open state. For example, if the rotor 92 rotates in a small angle from a position illustrated in Fig. 10, in the first radial passage 350 in which an opening on the center side of the rotor is in a half-open state in Fig. 10, an opening on the center side of the rotor exactly enters a fully open state. However, in this state, a partial cylindrical surface (a portion of the cylindrical surface) defining an opening edge of the rotor and a bottom surface (includes the chord and a plane parallel to the center line of the rotor 92) of the cutout section 360 facing the partial cylindrical surface are adjacent to each other, and an angle forming the both surfaces is small. Thus, the flow of air flowing from the cutout section 360 to the first radial passage 350 enters a state of being throttled. In this state, the first radial passage 350 is not in a state of being fully open, and as illustrated in Fig. 10, in the same manner as one first radial passage 350 corresponding to the adsorbing nozzle 90 at a component mounting position and the first radial passages 350 on both sides of the one first radial passage 350, the partial cylindrical surface defining the opening edge of the opening on the center side of the rotor of the first radial passage 350 is sufficiently separated from the bottom surface of the cutout section 360. In a case in which the flow of the air flowing from the cutout section 360 to the first radial passage 350 in in a state of not being throttled, it is said that the first radial passage 350 is in a fully open state.

[0037]

Alternatively, from the viewpoint of a formation purpose of the cutout section 360, it is preferable that, in a state in which one of the plurality of adsorbing nozzles 90 is located at a component mounting position, the cutout section 360 is provided in a state in which the plurality of first radial passages 350 corresponding to at least the one adsorbing nozzle and one or more adsorbing nozzles 90 located on an upstream side in a rotation direction of the rotor 92 higher than the one adsorbing nozzle 90 are in a fully open state. It is natural that the first radial passage 350 corresponding to the adsorbing nozzle 90 at a component mounting position has to be in a fully open state, as a formation purpose of the cutout section 360. However, it is preferable that the first radial passages 350 corresponding to the one or more adsorbing nozzles 90 located on an upstream side in the rotation direction of the rotor 92 higher than the one adsorbing nozzle 90 are also in a fully open state, because it is preferable that, regardless of a rotation speed of the rotor 92, during a time period in which the control valve device 280 is in a positive pressure source communicable state, positive pressure is supplied to the first radial passage 350 by more sufficient pressure.

[0038]

In addition, since a section in which the cutout section 360 of the communication control section 310 is not formed is a section which causes the first radial passage 350 to be in a closed state, the section is assumed to be referred to as a closing section 396. However, if viewing from a formation purpose of the closing section 396 as well, it is natural that, in a state in which the rotor 92 is stopped, the first radial passage 350 corresponding to one adsorbing nozzle 90 located at a component reception position has to be in a fully closed state. However, it is preferable that one or more first radial passages 350 corresponding to one or more adsorbing nozzles 90 located on an upstream side in the rotation direction of the rotor 92 higher than the one adsorbing nozzle 90 are also in a fully closed state. The reason is that it is preferable that, regardless of a rotation speed of the rotor 92, during a time period in which the control valve device 280 is in a negative pressure source communicable state, the inside of the adsorbing nozzle 90 is entirely in atmospheric pressure, and as soon as the control valve device 280 is in a negative pressure source communicable state, the inside of the adsorbing nozzle 90 has sufficient negative pressure.

[0039]

The cutout section 360 and the closing section 396 may be provided in a state of satisfying the above-described condition, and there is no problem in that an opening on a center side of the rotor of the first radial passage 350 other than those described above is in one of an open state and a closed state. Alternatively, in the present embodiment, as described above, from a viewpoint in which the cutout section 360 is easily formed by machining, in a state in which the rotor 92 stops rotation at a position illustrated in Fig. 10, in such a manner that one first radial passage 350 corresponding to the adsorbing nozzle 90 at a component mounting position and the first radial passages 350 on both sides of the one first radial passage 350 enter a fully open state, the cutout section 360 has an arch sectional shape defined by a chord and a circumference which correspond to a central angle of 120 degrees of the rotor 92, and the closing section 396 causes that one first radial passage 350 corresponding to the adsorbing nozzle 90 at a component reception position, another first radial passage 350 adjacent to an upstream side in a rotation direction of the rotor 92 of the one first radial passage 350, and the first radial passages 350 corresponding to the adsorbing nozzles 90 that are respectively stopped at five pivoting positions from a sixth pivoting position to a tenth pivoting position, are in a fully closed state. Thus, if a formation state of the first radial passage 350 in the rotor 92 is changed, a formation state of the cutout section 360 also has to be changed.

[0040]

Valve switching devices 370 and 372 are respectively provided in portions corresponding to the component mounting position and the component reception position of the head body 98. As illustrated in Fig. 4, the valve switching device 370 provided in the component mounting position includes a switching member 374 and a switching member drive device 376. The switching member drive device 376 uses an electric motor 378 (refer to Fig. 13) as a drive source, and rotates the switching member 374 in both forward and reverse directions around an axis line orthogonal to a rotation axis line of the rotor 92. Thereby, two engaging sections 380 and 382 that are configured by rollers of the switching member 374 are selectively engaged with an engaged section 384 of a plate shape of the valve spool 282, makes the valve spool 282 descend or ascend with respect to the nozzle holding section 96. As illustrated in Fig. 5, the valve switching device 372 provided at a component reception position includes a switching member 390 and a switching member drive device 392. The switching member drive device 392 includes an air cylinder 394 (refer to Fig. 13) that is a type of fluid pressure actuator, and makes the switching member 390 ascend or descend. A roller (not illustrated) is attached to the switching member 390 so as to be able to rotate around an axis line orthogonal to a rotation axis line of the rotor 92 thereby configuring an engaging section, is engaged with the engaged section 384, and presses down the valve spool 282.

[0041]

Furthermore, a mounting head control device 400 (refer to Fig. 13) is provided in the head body 98. The mounting head control device 400 is configured by using a mounting head control computer 402 as a main body. The mounting head control device 400 is connected to a module control computer 404 forming a main body of the module control device 34, and configures a component mounting control device together with the module control device 34. The mounting head control device 400 controls the electric motor 106 or the like configured by a servo motor with an encoder. Each encoder 406 such as the electric motor 106 is connected to the mounting head control computer 402 so as to representatively show one.

[0042]

As illustrated in Fig. 13, the module control device 34 controls drive sources or the like of various devices configuring the mounting modules 10 such as the linear motor 64 via a drive circuit 420. An input and output interface of the module control computer 404 is connected to an image processing computer 430 that processes data obtained by imaging of the reference mark imaging device 30 and the component imaging device 32, an encoder 432 (one is representatively illustrated in Fig. 13) provided in the electric motor 76 or the like of the X-axis slide moving device 74, the mounting head control computer 402, or the like. Alternatively, imaging data of the component imaging device 190 of the mounting head 26 is transferred to an image processing computer 430 and is processed by the image processing computer 430, and necessary data is transferred to the mounting head control computer 402. Furthermore, a RAM of the module control computer 404 stores various programs and data for components mounted on the board 44.

[0043]

In the mounting module 10 configured as described above, an operation is performed in which the adsorbing nozzle 90 takes out components 222 from the bulk feeder 200 and mounts components on one board 44. The twelve adsorbing nozzles 90 are sequentially pivoted to the component reception position by the rotation of the rotor 92, after receiving the components 222 from the bulk feeder 200, the components are imaged by the component imaging device 190 at a component imaging position, and the adsorbing nozzles 90 are pivoted to the component mounting position thereby mounting the components 222 on the board 44. At the time of mounting, a holding position error of the component 222 caused by the adsorbing nozzle 90 and a position error of a component mounting point of the board 44 that is obtained by imaging of a reference mark, is corrected. The valve feeder 200 moves together with the adsorbing nozzles 90 and supplies the components 222, the mounting head 26 is moved with respect to the circuit board holding device 22, the twelve adsorbing nozzles 90 are sequentially moved to the respective pivoting positions by rotation of the rotor 92, and reception of the components 222, imaging, and mounting are performed in parallel.

[0044]

When the adsorbing nozzle 90 on which the component 222 adsorbed is pivoted to the component mounting position, the control valve device 280 corresponding to the adsorbing nozzle 90 enters a negative pressure source communicable state, and negative pressure is supplied to the adsorbing nozzle 90 as illustrated in Fig. 14. If the adsorbing nozzle 90 reaches an eleventh pivoting position, the first radial passage 350 corresponding to the adsorbing nozzle 90 enters a half-closed state by the cutout section 360, and communication between the adsorbing nozzle 90 and the positive pressure source 290 is started as illustrated by a thick black line in Fig. 14. However, since the control valve device 280 corresponding to the adsorbing nozzle 90 is in a negative pressure source communicable state, positive pressure is not supplied to the adsorbing nozzle 90, and the adsorbing nozzle 90 is maintained in a state of holding the component 222. The first radial passage 350 corresponding to the adsorbing nozzle 90 that is stopped at a twelfth pivoting position enters a fully open state, and the first radial passage 350 is in a state in which the positive pressure is supplied, but the control valve device 280 corresponding to the adsorbing nozzle 90 is in a negative pressure source communicable state, and thus, positive pressure is also not supplied to the adsorbing nozzle 90.

[0045]

As illustrated in Fig. 4, an engaged section 168 of the nozzle holder 120 is elongated in a pivoting direction of the adsorbing nozzle 90, before the adsorbing nozzle 90 reaches the component mounting position, the lifting member 154 of the nozzle lifting device 150 descends thereby being engaged with the engaged section 168, and the adsorbing nozzle 90 descends while pivoting. The lifting member 154 is engaged with the engaged section 168 in the roller 164, and allows the pivoting of the adsorbing nozzle 90 by rotation of the roller 164. The valve switching device 370 operates while lowering of the adsorbing nozzle 90, the switching member 374 presses up the valve spool 282, and switches the control valve device 280 from a negative pressure source communicable state to positive pressure source communicable state. Thereby, the adsorbing nozzle 90 is cut out from the negative pressure source 292 and communicats with the positive pressure source 290, a negative pressure is positively extinguished by the supply of a positive pressure, and the component 222 is rapidly released thereby being mounted on the board 44. The first radial passage 350 corresponding to the adsorbing nozzle 90 starts to communicate with the cutout section 360, from the adsorbing nozzle 90 that reaches the eleventh pivoting position on two upstream sides in a rotation direction of the rotor from the component mounting position, the first radial passage 350 is in a fully open state at the time of reaching the twelfth pivoting position, the internal pressure of the first radial passage 350 has a sufficient positive pressure when the adsorbing nozzle 90 reaches the component mounting position, the cutout section 360 can communicate simultaneously with a plurality of first radial passages 350 and the positive pressure source 290, and in addition, formation is easily performed by machining as described above. As is apparent from the above description, the cutout section 360 is formed in a state in which three first radial passages 350 corresponding to the adsorbing nozzles 90 that are stopped at three pivoting positions around the component mounting position are in a fully open state, and in the present embodiment, an angle area slightly wider than a stop position of the three first radial passage 350 becomes a first setting angle area in which the first radial passage 350 is in a fully open state.

[0046]

The engaged section 384 of the valve spool 282 is elongated in a pivoting direction of the valve spool 282. In addition, the switching member 374 is engaged with the valve spool 282 in the roller, and the valve spool 282 can be pivoted together with the adsorbing nozzle 90 and can be pushed up by engagement with the engaged section 384 of the roller and rotation of the roller. After component mounting, the adsorbing nozzle 90 ascends, pivots, and moves to the component reception position. Even in this case, ascending and pivoting of the adsorbing nozzle 90 is performed in parallel. After the control valve device 280 is switched, the switching member 374 is then returned to a position in which switching of the control valve device 280 corresponding to the adsorbing nozzle 90 that reaches the component mounting position is performed. Then, when the adsorbing nozzle 90 pivots from a third pivoting position to a fourth pivoting position, the first radial passage 350 corresponding to the adsorbing nozzle 90 deviates from the cutout section 360, as illustrated in Fig. 14, and communication with the positive pressure source 290 is cut out. Thereby, the control valve device 280 is in a positive pressure source communicable state, but communication between the adsorbing nozzle 90 and the positive pressure source 290 is blocked, an internal pressure of the adsorbing nozzle 90 is decreased, and eventually becomes atmospheric pressure.

[0047]

In the same manner as at the time of component mounting, the adsorbing nozzle 90 descends while being pivoted from the fourth pivoting position to the component reception position, and the control valve device 280 is switched from a positive pressure source communicable state to a negative pressure source communicable state by the valve switching device 372, in parallel to the descending. It is because the switching member 390 presses down the valve spool 282. After the adsorbing nozzle 90 is stopped at the third pivoting position, communication with the positive pressure source 290 is cut off, internal pressure is decreased to atmospheric pressure, and thereby while the control valve device 280 is switched to a negative pressure source communicable state, compressed air is blown from the adsorbing nozzle 90, and the component 222 that is supplied by the valve feeder 200 is not blown away. If the adsorbing nozzle 90 passes through the pivoting position on the two upstream sides in the rotation direction of the rotor from the component reception position, communication with the positive pressure source 290 of the adsorbing nozzle 90 is cut off, and the internal pressure of the adsorbing nozzle 90 is sufficiently decreased until switching of the control valve device 280 is performed at the component reception position. That is, in the present embodiment, one first radial passage 350 corresponding to the adsorbing nozzle 90 that is stopped at the component reception position, and another first radial passage 350 corresponding to the adsorbing nozzle 90 that is stopped at the fourth pivoting position on an upstream side in a rotation direction of the rotor higher than the one first radial passage 350, are in a fully closed state by the closing section 396. As is apparent from Fig. 14, the first radial passages 350 corresponding to the adsorbing nozzles 90 that are stopped at the tenth pivoting position are in a fully closed state, and an angle area slightly wider than an interval between the first radial passages 350 corresponding to the adsorbing nozzles 90 that are respectively stopped at the fourth pivoting position and the tenth pivoting position is made to a second setting angle area in which the first radial passages 350 are in a fully closed state.

As is apparent from the above description, in the present embodiment, the supporting shaft 302 and the head body 98 configure a non-rotation section, and the communication control section 310 and the passage 312 configure a nozzle and positive pressure source communicating and blocking section.

[0048]

By switching of the control valve device 280 from a positive pressure source communicable state to a negative pressure source communicable state, the adsorbing nozzle 90 communicats with the negative pressure source 292 thereby negative pressure is supplied, and the component 222 is adsorbed. The adsorbing nozzle 90 is pivoted in parallel to ascending, takes out the component 222 from the valve feeder 200, and moves to a next pivoting position. The lifting member 172 of the nozzle lifting device 152 is engaged with the engaged section 168 of the nozzle holders 120 in the roller, and allows pivoting of the adsorbing nozzle 90 by rotation of the roller. In addition, the switching member 390 of the valve switching device 372 is engaged with the valve spool 282 by the roller, the valve spool 282 can be pivoted together with the adsorbing nozzle 90 by rotation of the roller, and can be pressed down. After switching of the control valve device 280, the switching member 390 is then returned to a position in which switching of the control valve device 280 corresponding to the adsorbing nozzle 90 that reaches the component reception position is performed.

[0049]

In this way, in the present mounting modules 10, receiving and mounting of the component 222 are performed in parallel, switching of the control valve device 280 is performed in parallel to descending of the adsorbing nozzle 90, and a high efficiency of mounting is obtained. In addition, even if pivoting and lifting of the adsorbing nozzle 90 in the vicinity of the component reception position is performed in parallel, mounting efficiency is improved. In the present mounting head 26, the valve switching device 372 that performs switching of the control valve device 280 at the time of receiving the component is provided in a portion corresponding to the component reception position of the head body 98, and in a case in which pivoting and lifting of the adsorbing nozzle 90 is performed in parallel, switching of the control valve device 280 is performed at the time of approaching the valve feeder 200 of the adsorbing nozzle 90. There is no risk that the component 222 is blown away, and thereby while the adsorbing nozzle 90 pivots and approaches the valve feeder 200, switching of the control valve device 280 can be performed, time required for receiving the component can be reduced, and mounting efficiency can be further improved. In addition, pivoting and lifting of the adsorbing nozzle 90 is performed in parallel in the vicinity of the component mounting position, and thereby mounting efficiency is improved.

Reference Signs List

[0050]

26: rotary type mounting head 28: mounting head moving device 34: module control device 90: adsorbing nozzle 92: rotor 98: head body 104: rotor rotation device 150, 152: nozzle lifting device 200: bulk feeder 280: control valve device 300: central hole 302: supporting shaft 310: communication control section 350: first radial passage 352: second radial passage 360: cutout section 396: closing section

Claims

[Claim 1]

An electronic circuit component mounting apparatus comprising:

a circuit base member holding device that holds a circuit base member;

a component supply device that supplies an electronic circuit component;

a positive pressure source that supplies positive pressure;

a negative pressure source that supplies negative pressure;

a rotary type mounting head that includes (a) a rotor that is rotatable around one axis line, (b) a plurality of adsorbing nozzles that are held so as to move forward and backward in an axis direction at a plurality of positions on one circumference around the one axis line of the rotor, and holds by adsorbing an electronic circuit component, using the negative pressure, (c) a rotor rotation device that intermittently rotates the rotor, thereby pivoting the plurality of adsorbing nozzles which is held in the rotor, and stops the respective adsorbing nozzles at predetermined pivoting positions, and (d) a head body that holds the rotor rotation device and the rotor;

a mounting head moving device that moves the rotary type mounting head with respect to the circuit base member holding device; and

a component mounting control device that controls the rotary type mounting head and the mounting head moving device, thereby the plurality of adsorbing nozzles that is held in the rotor receives electronic circuit components from the component supply device, and makes the circuit base member holding device hold the electronic circuit components,

wherein the rotary type mounting head further includes

(e) a component feeder that, in a state in which electronic circuit components which are accommodated in a component accommodation section are aligned in a row, sequentially supplies the electronic circuit components from a sequential component supply section to a adsorbing nozzle that is stopped at a component reception position that is one of the predetermined pivoting positions among the plurality of adsorbing nozzles, and serves as at least a portion of the component supply device;

(f) a positive pressure control valve that sets an adsorbing nozzle which pivots to the vicinity of a component mounting position that is one of the predetermined pivoting positions, among the plurality of adsorbing nozzles, to a state of being communicable with the positive pressure source, according to an intermittent rotation of the rotor;

(g) a negative pressure control valve that sets an adsorbing nozzle which pivots to the component reception position, among the plurality of adsorbing nozzles, to a state of being communicable with the negative pressure source, according to an intermittent rotation of the rotor;

(h) a nozzle advancing and retreating device that makes an adsorbing nozzle which is pivoted to the vicinity of the component reception position and the vicinity of the component mounting position, among the plurality of adsorbing nozzles that is held in the rotor, advance and retreat in an axis direction with respect to the rotor; and

(i) a nozzle and positive pressure source communicating and blocking section that is provided in a non-rotation section regardless of rotation of the rotor, among a plurality of stop positions in which each of the plurality of adsorbing nozzles that are held in the rotor by the intermittent rotation of the rotor is stopped, in a first setting angle area corresponding to one or more stop positions including the component mounting position, allows a sufficient communication between an adsorbing nozzle at a stop position corresponding to the first setting angle area and the positive pressure source, and in a second setting angle area corresponding to one or more stop positions including the component reception position, blocks communication between an adsorbing nozzle at a stop position corresponding to the second setting angle area and the positive pressure source.

[Claim 2]

The electronic circuit component mounting apparatus according to Claim 1,

wherein a plurality of radial passages is formed in the rotor in a state of extending in a radial shape from a central hole of the rotor to a plurality of positions corresponding to each of the plurality of adsorbing nozzles, and

wherein the nozzle and positive pressure source communicating and blocking section further includes

a communication control section having a cutout section that is relatively and rotatably fit to the central hole, and sets radial passages corresponding to one or more adsorbing nozzles at a stop position corresponding to the first setting angle area, among the plurality of radial passages, to a fully open state, according to rotation of the rotor, and having a closing section that sets radial passages corresponding to one or more adsorbing nozzles at a stop position corresponding to the second setting angle area, to a fully closed state; and

a positive pressure source communication passage that makes the cutout section communicate with the positive pressure source, regardless of a rotation position of the rotor.

[Claim 3]

The electronic circuit component mounting apparatus according to Claim 2,

wherein, in a state in which one of the plurality of adsorbing nozzles is located at the component mounting position, the cutout section of the communication control section sets a plurality of radial passages corresponding to at least the one adsorbing nozzle and one or more adsorbing nozzles located on an upstream side in a rotation direction of the rotor higher than the one adsorbing nozzle, to a fully open state.

[Claim 4]

The electronic circuit component mounting apparatus according to Claim 2 or 3,

wherein, in a state in which one of the plurality of adsorbing nozzles is located at the component mounting position, the closing section of the communication control section sets a plurality of radial passages corresponding to at least the one adsorbing nozzle and one or more adsorbing nozzles located on an upstream side in a rotation direction of the rotor higher than the one adsorbing nozzle, to a fully closed state.

[Claim 5]

The electronic circuit component mounting apparatus according to any one of Claims 2 to 4, further comprising:

a plurality of second radial passages different from first radial passages that are the plurality of radial passages which is formed in the rotor in a state of extending in a radial manner from a central section of the rotor to positions corresponding to each of the plurality of adsorbing nozzles; and

a negative pressure source communication passage that makes the second radial passages communicate with the negative pressure source, regardless of a rotation position of the rotor.

[Claim 6]

The electronic circuit component mounting apparatus according to Claim 5,

wherein the plurality of first radial passages and the plurality of second radial passages are respectively formed in portions which are separated from each other in a direction parallel to the one axis line that is a rotation axis line of the rotor, and

wherein the positive pressure source communication passage and the negative pressure source communication passage extend from positions in which the first radial passage and the second radial passage respectively communicate with each other, in a direction opposite to each other which is parallel to the one axis line that is a rotation axis line of the rotor.

[Claim 7]

The electronic circuit component mounting apparatus according to any one of Claims 1 to 6,

wherein the nozzle advancing and retreating device makes the adsorbing nozzle advance and retreat in parallel to pivoting of the adsorbing nozzle according to rotation of the rotor performed by the rotor rotation device, in the vicinity of the component reception position.

Abstract

An electronic circuit component mounting apparatus that includes a plurality of adsorbing nozzles, a component feeder, and a rotary type mounting head which moves with respect to a circuit base member holding device, is improved. Radial passages 350 and control valve devices 280 are provided in correspondence to each of a plurality of adsorbing nozzles 90, in a rotor 92 of a communication control section 310 of non-rotation fit to a central hole of the rotor 92, while a cutout section 360 that usually communicates with a positive pressure source is formed in a portion corresponding to a component mounting position. In a state in which the rotor 92 rotates and the radial passage 350 corresponding to the adsorbing nozzle 90 in the vicinity of the component mounting position fully communicates with the cutout section 360, the control valve device 280 enters a positive pressure source communicable state and thereby a positive pressure is supplied to the adsorbing nozzle 90, and a component is rapidly released. If the radial passage 350 deviates from the cutout section 360, the adsorbing nozzle 90 is cut out from the positive pressure, and thereby an internal pressure is decreased. During descending of the adsorbing nozzle 90 in the vicinity of a component reception position, a component of a component feeder is prevented from being blown away due to positive pressure.

Drawings

Fig. 1

34: MODULE CONTROL DEVICE

34: MODULE CONTROL DEVICE

Fig. 6

290: POSITIVE PRESSURE SOURCE

292: NEGATIVE PRESSURE SOURCE

Fig. 7

COMPONENT MOUNTING POSITION

(COMPONENT RECEPTION AND MOUNTING POSITION)

FIRST PIVOTING POSITION

SECOND PIVOTING POSITION

THIRD PIVOTING POSITION

FOURTH PIVOTING POSITION

FIFTH PIVOTING POSITION

COMPONENT RECEPTION POSITION

SIXTH PIVOTING POSITION

SEVENTH PIVOTING POSITION

COMPONENT IMAGING POSITION

EIGHTH PIVOTING POSITION

NINTH PIVOTING POSITION

TENTH PIVOTING POSITION

ELEVENTH PIVOTING POSITION

TWELFTH PIVOTING POSITION

Fig. 10

COMPONENT IMAGING POSITION

COMPONENT RECEPTION POSITION

COMPONENT MOUNTING POSITION

Fig. 13

INPUT AND OUTPUT INTERFACE

420: DRIVE CIRCUIT

420: DRIVE CIRCUIT

420: DRIVE CIRCUIT

420: DRIVE CIRCUIT

50: TAPE FEEDER

20: CIRCUIT BOARD TRANSPORT DEVICE

22: CIRCUIT BOARD HOLDING DEVICE

64: LINEAR MOTOR

76: ELECTRIC MOTOR

400: MOUNTING HEAD CONTROL DEVICE

402: MOUNTING HEAD CONTROL UNIT

190: COMPONENT IMAGING DEVICE

406: ENCODER

106: ELECTRIC MOTOR

142: ELECTRIC MOTOR

158: ELECTRIC MOTOR

180: ELECTRIC MOTOR

240: ELECTRIC MOTOR

378: ELECTRIC MOTOR

394: AIR CYLINDER

430: IMAGE PROCESSING COMPUTER

432: ENCODER

30: REFERENCE MARK IMAGING DEVICE

32: COMPONENT IMAGING DEVICE

Fig. 14

COMPONENT MOUNTING POSITION

(COMPONENT RECEPTION AND MOUNTING POSITION)

FIRST PIVOTING POSITION

NEGATIVE PRESSURE à POSITIVE PRESSURE

POSITIVE PRESSURE SECOND PIVOTING POSITION

POSITIVE PRESSURE THIRD PIVOTING POSITION

ATMOSPHERIC PRESSURE FOURTH PIVOTING POSITION

ATMOSPHERIC PRESSURE à NEGATIVE PRESSURE

FIFTH PIVOTING POSITION

COMPONENT RECEPTION POSITION

NEGATIVE PRESSURE

SIXTH PIVOTING POSITION

NEGATIVE PRESSURE

SEVENTH PIVOTING POSITION

COMPONENT IMAGING POSITION

NEGATIVE PRESSURE

EIGHTH PIVOTING POSITION

NEGATIVE PRESSURE

NINTH PIVOTING POSITION

NEGATIVE PRESSURE

TENTH PIVOTING POSITION

NEGATIVE PRESSURE

ELEVENTH PIVOTING POSITION

NEGATIVE PRESSURE

TWELFTH PIVOTING POSITION