DESCRIPTION

BUMP BONDING DEVICE AND BUMP BONDING METHOD

TECHNICAL FIELD

The present invention relates to a bump bonding device for forming bump electrodes on electrodes of semiconductor electronic parts, and its method.

BACKGROUND ART

Referring to Fig. 6 to Fig. 11, conventional bump bonding device and bump bonding method are described below.

Fig. 6 is a perspective view of a bump bonding device for forming a bump on an electronic part 3 by using a gold wire 13.

In the diagram, the electronic part 3 supplied from a tray 10 is fixed on a heated stage 1 by means of a suction collet 11. A capillary 12 is held by an ultrasonic feed unit, and is provided with an ultrasonic wave, and a gold bump is formed on the electrode of the electronic part 3 by the capillary 12 in which the gold wire 13 is passed. After forming bumps on specified positions thereof, the electronic part 3 is stored in a tray 10a by means of the suction collet 11.

Fig. 7 is a process diagram showing the bump forming

process.

First, at step (a), the gold wire 13 is passed in the capillary 12, a spark is ignited on the tip of the gold wire 13, and a ball is formed on the tip. At next step (b), the capillary 12 is lowered to press on an electrode 14 of the electronic part 3. At this time, an ultrasonic wave is applied to bond the electrode 14 and gold wire 13 (1st bonding). At step (c), consequently, the capillary 12 is lifted, and is lowered again while controlling the loop, and, at step (d), the capillary 12 presses on the gold ball of first bonding, and cuts off the gold wire 13 (2nd bonding).

A regulating section of electronic parts is described in detail below.

Fig. 8 is a plan view of electronic parts regulating section.

As shown in Fig. 8, the regulating section of the bump bonding device is composed of a stage 1 having a suction hole, a regulating pawl 2 movable in the XY direction, and a regulating spring 5 for applying a regulating force in the Y direction of the regulating pawl 2, in which the electronic part 3 moves on the suction hole of the stage 1 by means of the regulating pawl 2, and is regulated in position on the stage 1 by vacuum suction. However, the suction force is insufficient for a tiny electronic part, a

regulating section as shown in Fig. 9 is used.

As shown in Fig. 9, the regulating section is composed a stage 1, a plate 4 fixed at an end of the stage 1, a regulating pawl 2 movable in the XY direction, and a regulating spring 5 for applying a regulating force in the Y direction of the regulating pawl 2.

In this regulating section, it is hard to set the regulating pawl parallel to the plate 4, and therefore when regulating the position of the electronic part 3, if a regulating force is applied to the electronic part 3 by the regulating pawl 2, a corner 3a of the electronic part may collide against the plate 4, and the electronic part may be broken.

Fig. 10 is a flowchart showing operation by the conventional electronic parts regulating device.

The electronic part is put on the stage 1 of the bump bonding device, the suction device is turned on, the electronic part is positioned, and, in this state, the electronic part 3 is bonded. In the case of a tiny electronic part, however, the suction hole is not suited to the dimension of the electronic part, or the suction hole located on the regulating track of the electronic part cannot be blocked according to the dimension of the electronic part, and suction errors often took place.

Generally, a tiny electronic part is fragile, and

therefore when handling a tiny electronic part, it is required to decrease the impact force when regulating the position to prevent breakage of electronic part. It is hence an object of the invention to present an electronic part of high reliability, free from breakage when positioning the electronic part. Besides, if suction error occurs, the electronic part is likely to be cooled and defective bonding is caused, and, therefore, by preventing suction error, it is also an object of the invention to present an electronic part of high reliability with a lower rate of defective bonding.

SUMMARY OF THE INVENTION

The bump bonding device of the invention comprises a stage for mounting and heating an electronic part, and a position regulating device of electronic part including a rotatable regulating plate having a side for positioning the electronic part, a plate having a side for positioning the electronic part in collaboration with the regulating plate, and a regulating spring for applying a regulating force to the regulating plate in order to press the electronic part to the plate, and therefore the electronic part is regulated as being bonded between the regulating plate and the plate surface, and breakage is prevented, so that the reliability of electronic parts can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view showing a regulated state of an electronic part in an embodiment of the invention.

Fig. 2 is a plan view showing a regulated state of an electronic part in an embodiment of the invention.

Fig. 3 is a plan view showing a regulated state of an electronic part in an embodiment of the invention.

Fig. 4 is a plan view showing configuration of suction holes and moving track of electronic parts in an embodiment of the invention.

Fig. 5 is a flowchart showing regulating action of electronic part in an embodiment of the invention.

Fig. 6 is a perspective view of a conventional bump bonding device.

Fig. 7 is a bump bonding process diagram showing a conventional bump shape.

Fig. 8 is a plan view showing a regulated state of a conventional electronic part.

Fig. 9 is a plan view showing a regulated state of a conventional electronic part.

Fig. 10 is a flowchart showing action by a conventional regulating device of electronic parts.

BEST MODE OF CARRYING OUT THE INVENTION

The invention as set forth in claim 1 comprises a stage for mounting and heating an electronic part, and a position regulating device including a rotatable regulating plate having a side for positioning the electronic part, a plate having a side for positioning the electronic part in collaboration with the regulating plate, and a regulating spring for applying a regulating force to the regulating plate in order to press the electronic part to the plate, and therefore the electronic part is regulated in position as being bonded between the surfaces of the regulating plate and the plate, and breakage of the electronic part is prevented, so that the reliability of electronic part can be enhanced.

In the invention as set forth in claim 2, the rotatable regulating plate is provided with a balance spring at right angle to the regulating spring in order to prevent excessive rotation in the rotating direction, and the same action as in claim 1 is obtained.

In the invention as set forth in claim 3, a regulating spring is provided at one side of the balance spring, and the regulating force is applied also to the balance spring, and the same action as in claim 1 is obtained.

The invention as set forth in claim 4 relates to a bump bonding method in the bump bonding device disposed on the moving track of electronic parts when regulating the

electronic parts, and having suction holes for sucking electronic parts by vacuum, which comprises a step of putting electronic parts on a stage, a step of turning on suction of electronic parts by suction holes in the stage, a step of moving electronic parts along the suction holes arranged on the moving track of the electronic parts, and pressing the electronic parts to the plate by a regulating plate to position, and a step of turning off the suction of electronic parts, and therefore cooling of electronic parts due to suction error of electronic parts is prevented and defective bonding is avoided, so that the reliability of electronic parts can be enhanced.

Embodiments of the invention are described below while referring to Fig. 1 to Fig. 5.

(Embodiment 1)

Fig. 1 is a plan view showing a regulated state of an electronic part in an embodiment of the invention, in which an electronic plate 3 is supported by a plate 4 at one side, and by sides of a regulating plate 2 at other two sides. The regulating plate 2 is provided with a regulating force in the spring direction by means of a regulating spring 5, and is provided rotatably about a fulcrum 6. Therefore, when regulating the position of the electronic part, since the electronic part 3 is regulated in position by

contacting with the surfaces of the regulating plate 2 and plate 4, concentrated load is not applied to the electronic part 3, breakage of electronic part 3 is prevented, so that the reliability of the electronic part 3 can be enhanced.

(Embodiment 2)

Fig. 2 is a plan view showing a regulated state of an electronic part in other embodiment of the invention, the description of the same constitution as in Fig. 1 is omitted. In Fig. 2, what differs from Fig. 1 is that a balance spring 7 is provided at right angle to the regulating spring 5. In this constitution, when the regulating plate 2 rotates about the fulcrum 6, excessive rotation of the regulating plate 2 is prevented by spring force by the balance spring 7, so that the surface of the regulating plate 2 may be maintained at the same level as the surface of the electronic part 3. Accordingly, same as in embodiment 1, breakage of the electronic part 3 can be prevented.

As a specific example of this embodiment, the electronic part 3 was made of a silicon IC chip measuring 1.4 x 1.3 (mm) and 0.3 (mm) in thickness, and the regulating spring 5 was adjusted in the regulating push-in extent so that the maximum load be 50 g, and a load of 200 g was applied to the actual electronic part 3. The maximum

load of the balance spring 7 was 300 g each.

(Embodiment 3)

Fig. 3 is a plan view showing a regulated state of an electronic part in a different embodiment of the invention, the description of the same constitution as in Fig. 2 is omitted. In Fig. 3, what differs from Fig. 2 is that a regulating spring 5b is provided in the same direction as the thrusting direction of the balance spring 7, and that notches are formed at four corners of the plate 4 so as to bonded with the electronic part 3 at two sides. In this constitution, regulating force is applied also in the thrusting direction of the balance spring 7, so that the electronic part 3 may be fixed more stably.

(Embodiment 4)

Fig. 4 is a plan view showing configuration of suction holes and moving track of electronic parts in other different embodiment of the invention, and Fig. 5 is a flowchart showing its action. In Fig. 4, reference numerals 8a to 8e are suction holes for sucking the electronic part 3 by vacuum.

First, when the electronic part 3 is put on position 9a of the stage 1, the electronic part 3 is sucked by the suction hole 8a. At this time, if the electronic part 3 is

not sucked by the suction hole 8a, the electronic part 3 rotates or sticks to the nozzle side if attempted to mount. In Fig. 4, the regulating plate 2 is already in contact with the electronic part 3, but when the electronic part 3 is put on the stage 1, the electronic part 3 is no longer contacting with the regulating plate, and they contact with each other only when the electronic part 3 is sucked. Later, the electronic part 3 moves on the suction holes 8a to 8e. At this time, all suction holes are sucking, the electronic part 3 moves neatly along the suction holes and is fixed at position 8e (see embodiments 1 and 2). Then, the suction of the suction holes 8a to 8e is cut off. In this constitution, occurrence of suction error can be prevented, and therefore the electronic part 3 is not cooled, and defective bonding is prevented.

In this embodiment, five suction holes 8 are provided, but the number or configuration is not specifically defined, and various forms are possible. It is also applicable to the stage capable of bonding a plurality of electronic parts.

INDUSTRIAL APPLICABILITY

Thus, according to the invention, since concentrated load is not applied to a point of electronic part when regulating the electronic part, breakage of electronic part

can be prevented. Moreover, since cooling of electronic part can be prevented, defective bonding can be avoided, so that the reliability of the electronic part can be enhanced.

* C L M S *

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CLAIMS

1. A bump bonding device comprising

a stage for mounting and heating an electronic part, and

a position regulating device including a rotatable regulating plate having a side for positioning the electronic part, a plate having a side for positioning the electronic part in collaboration with said regulating plate, and a regulating spring for applying a regulating force to the regulating plate in order to press the electronic part to the plate.

2. A bump bonding device of claim 1, wherein the rotatable regulating plate includes with a balance spring disposed at right angle to the regulating spring in order to prevent excessive rotation in the rotating direction.

3. A bump bonding device of claim 2, wherein said position regulating device a regulating spring disposed at one side of the balance spring, and the regulating force is applied also to the balance spring by the regulating spring.

4. A bump bonding method in a bump bonding device which has suction holes for sucking electronic parts by

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* C L M S *

vacuum and is disposed on a moving track of electronic parts when regulating the electronic parts,

said method comprising the steps of;

putting electronic parts on a stage,

turning on suction of electronic parts by suction holes in the stage,

moving electronic parts along the suction holes arranged on the moving track of the electronic parts, and pressing the electronic parts to the plate by a regulating plate to position, and

turning off the suction of electronic parts.

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ABSTRACT OF THE DISCLOSURE

To eliminate breakage of electronic parts or defective bonding, and enhance reliability of electronic parts, in regulation of electronic parts in bump bonding device. A bump bonding device comprising a stage 1 for mounting and heating an electronic part, and a position regulating device including a rotatable regulating plate 2 having a side for positioning the electronic part, a plate 4 having a side for positioning the electronic part in collaboration with the regulating plate, and a regulating spring 5 for applying a regulating force to the regulating plate in order to press the electronic part to the plate 4.

Fig. 1

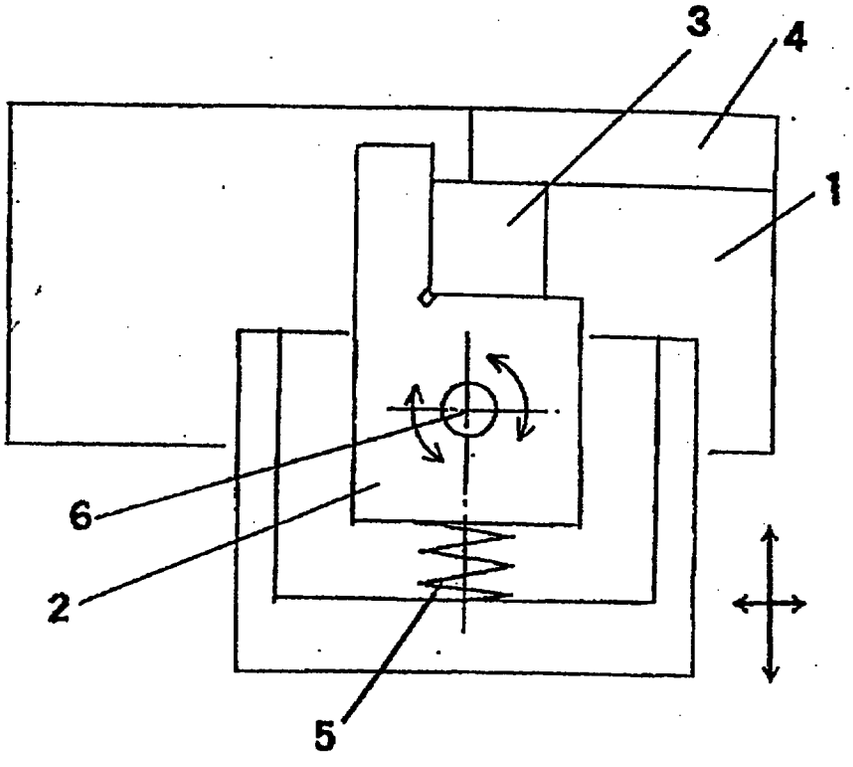


Fig. 2

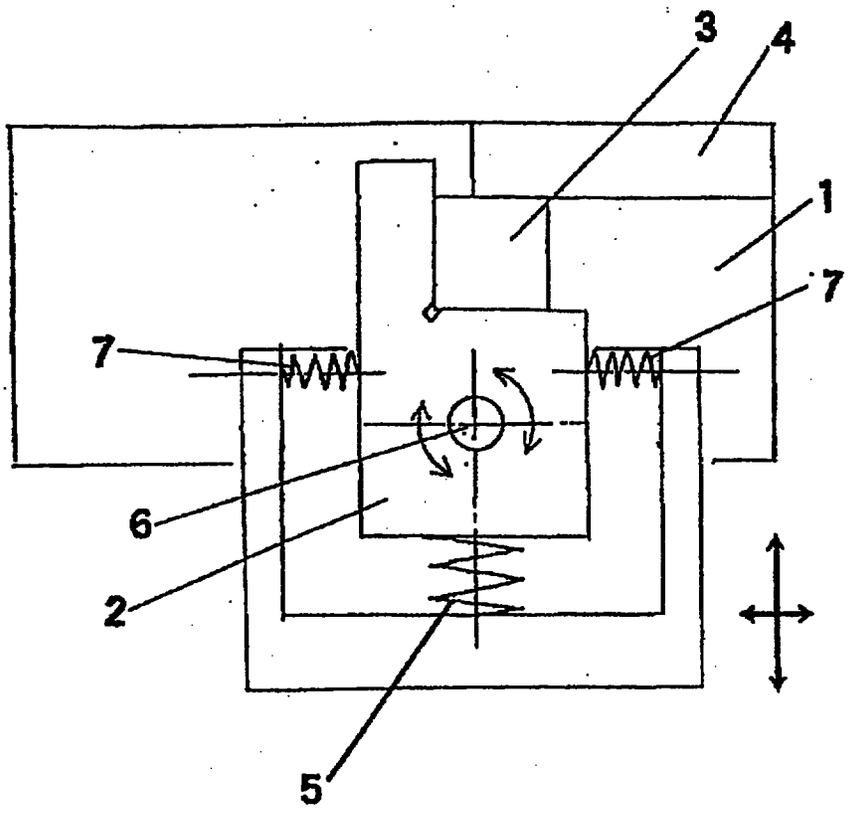


Fig. 3

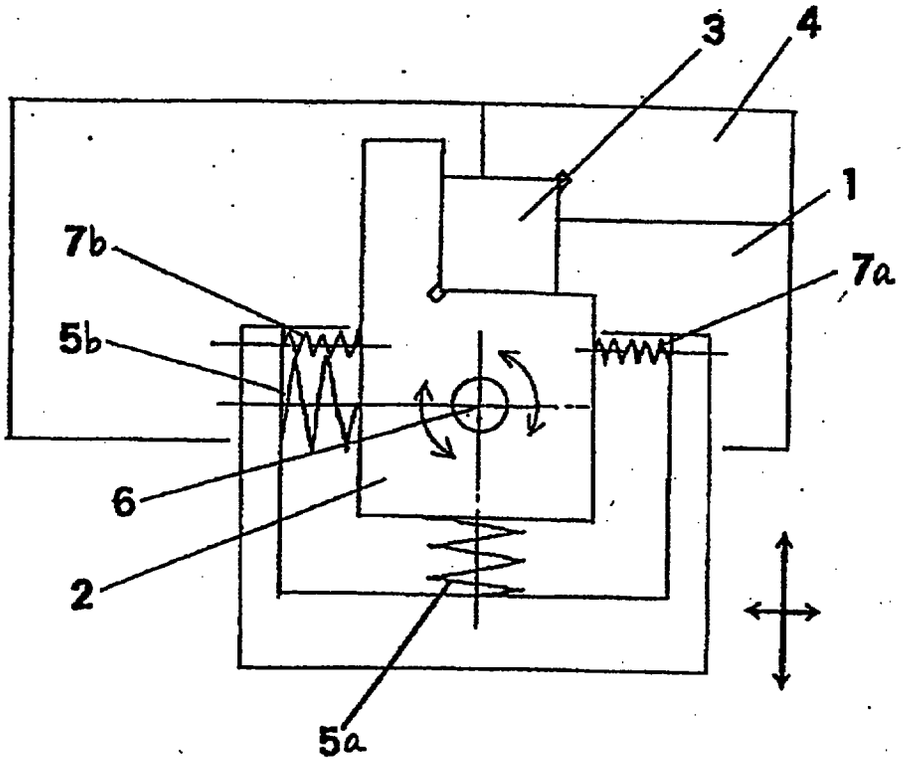


Fig. 4

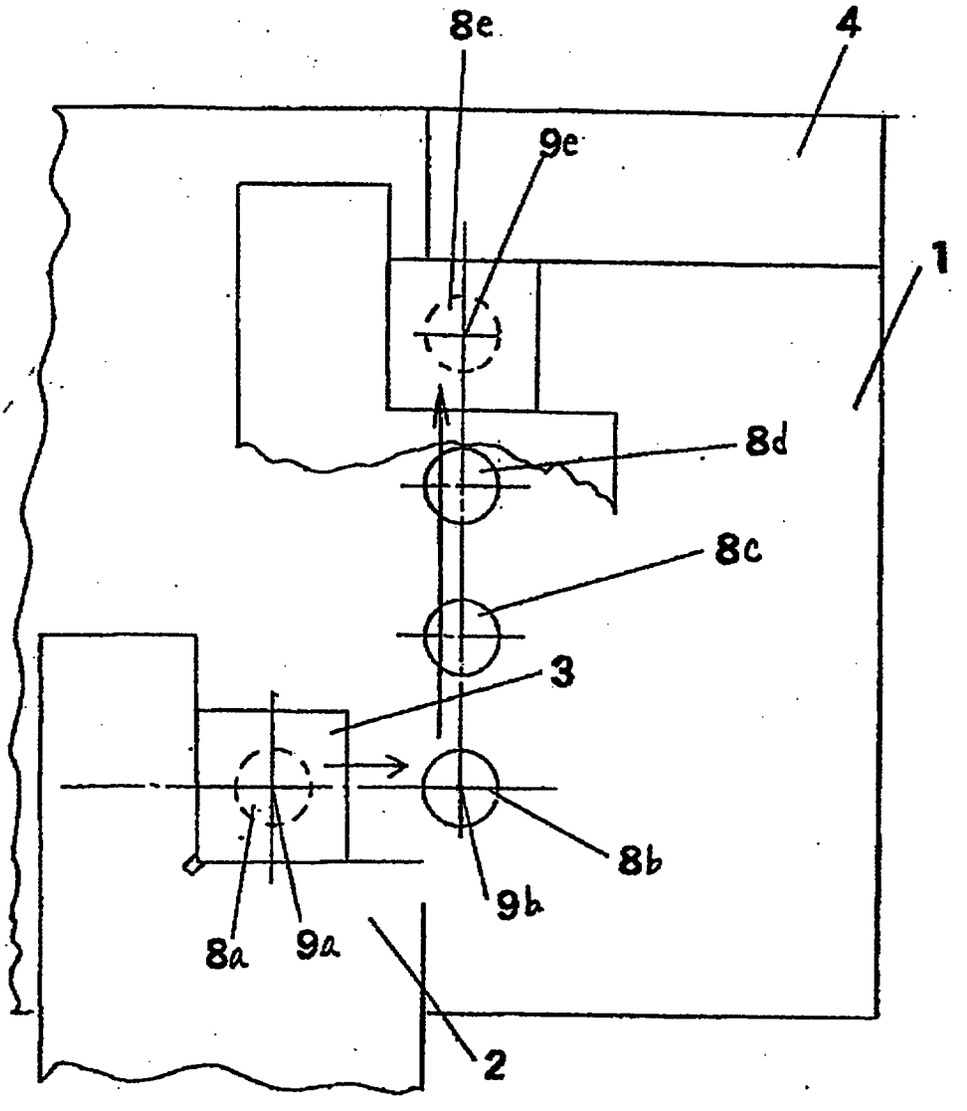


Fig. 5

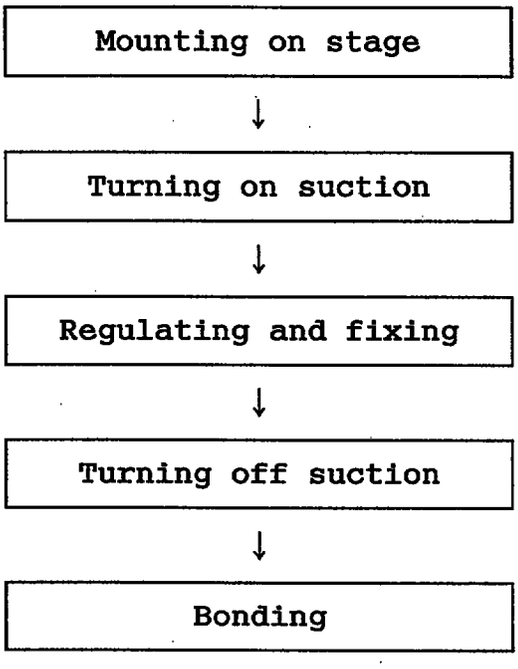

Mounting on stage
Turning on suction
Regulating and fixing
Turning off suction
Bonding

Fig. 6

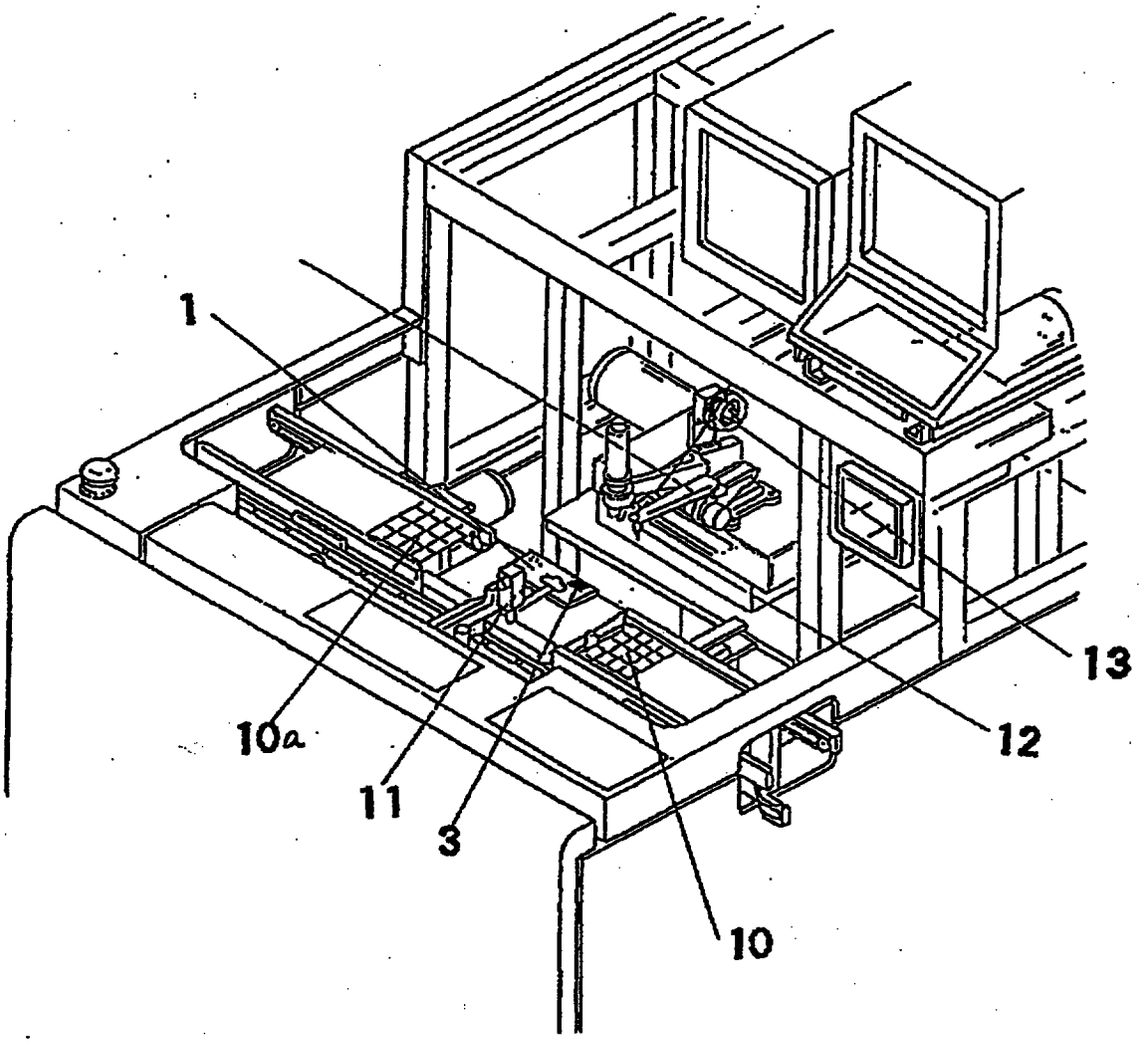


Fig. 7

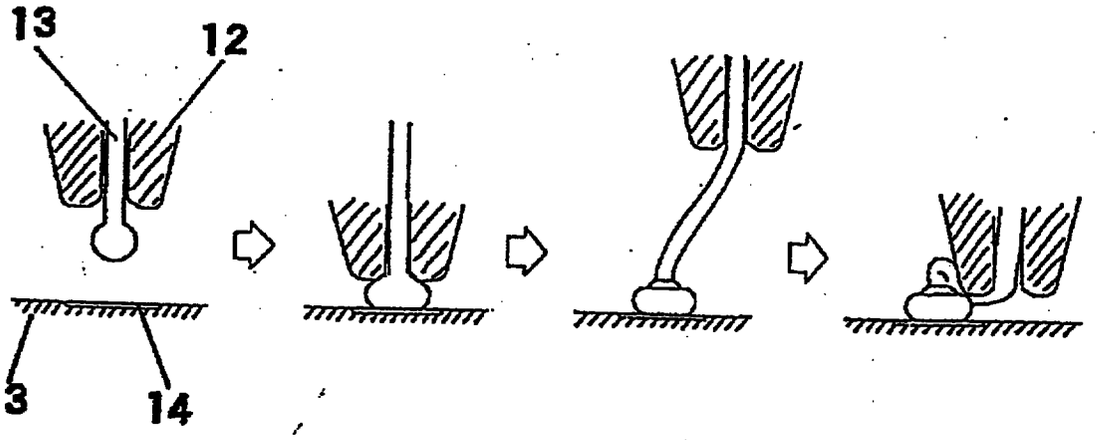


Fig. 8

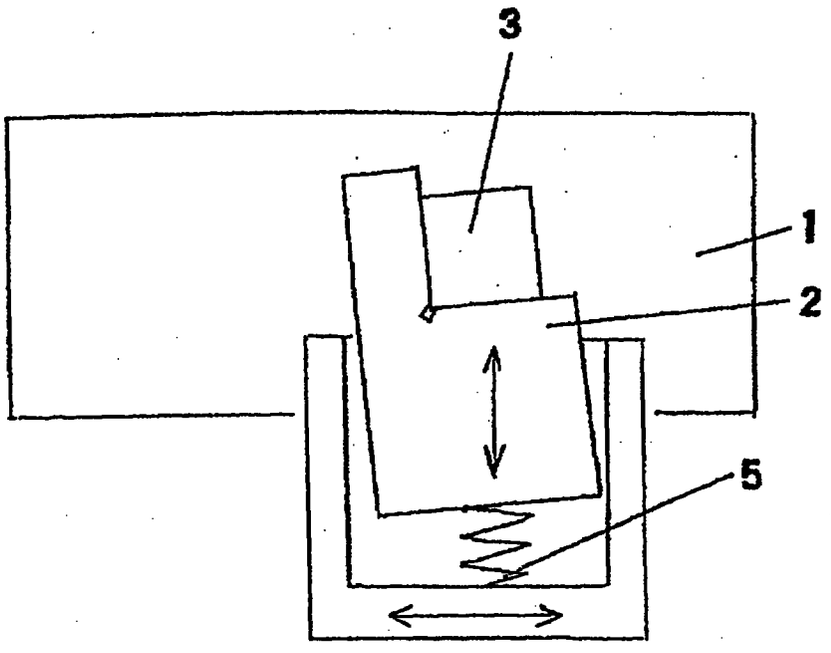


Fig. 9

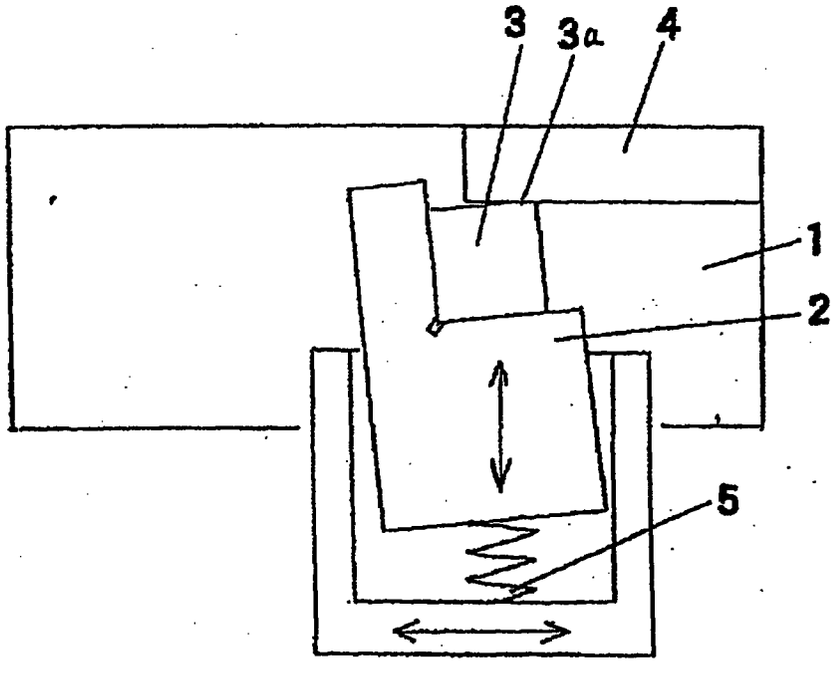
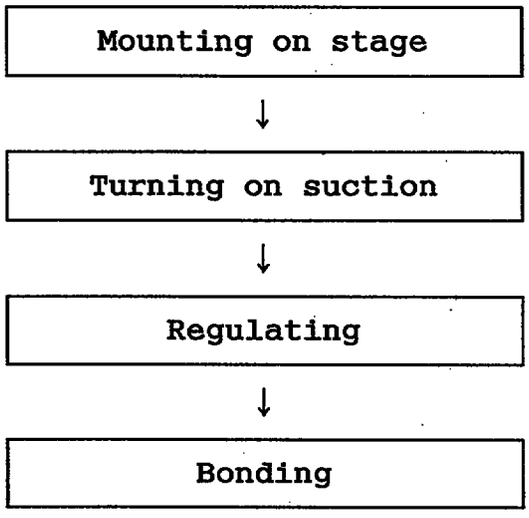


Fig. 10



CLAIMS

1. A bump bonding device comprising

a stage for mounting and heating an electronic part, and

a position regulating device including a rotatable regulating plate having a side for positioning the electronic part, a plate having a side for positioning the electronic part in collaboration with said regulating plate, and a regulating spring for applying a regulating force to the regulating plate in order to press the electronic part to the plate.

2. A bump bonding device of claim 1, wherein the rotatable regulating plate includes with a balance spring disposed at right angle to the regulating spring in order to prevent excessive rotation in the rotating direction.

3. A bump bonding device of claim 2, wherein said position regulating device a regulating spring disposed at one side of the balance spring, and the regulating force is applied also to the balance spring by the regulating spring.

4. (deleted)

5. (added) A bump bonding method comprising the steps of:

(a) putting electronic parts on a stage,

(b) starting suction of said electronic parts by a suction hole formed in said stage,

(c) moving said electronic parts on a moving track while sucking said electronic parts by a plurality of suction holes arranged and formed in said stage,

(d) pressing said electronic parts to a plate fixed at a specified position of the stage while pushing the regulating plate to be in contact with said electronic parts, and positioning and regulating the electronic parts at the specified positions, and

(e) releasing the suction of the positioned and regulated electronic parts.

6. (added) A bump bonding method of claim 5, wherein at said step (d), said electronic parts move on said moving track while being pushed to said regulating plate.

7. (added) A bump bonding method of claim 6, wherein said regulating plate contacts with said electronic parts after said electronic parts are sucked by said suction holes.

ANSWER

Examiner :Takuya Imai, Patent Office of Japan (P15191-P0)

1. International Application No.

PCT/JP97/02075

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4. Date of notice: 03.10.98

5. Description of reply

(1) This is our reply to the PCT opinion in conformity with the stipulation in Law Article 13 (PCT Rule 66) concerning the international application on the basis of the Patent Cooperation Treaty concerning the application of the present case.

(2) It is said that claim 4 lacks novelty and progressiveness in the light of the reference (JP, 8-784186,A), but we are certain that the present invention is not easily devised from the cited reference on the basis of the following reasons.

The bump bonding method as set forth in claim 5 included in the amendments added after application of the present case further comprises (d) a step of pressing said electronic parts to a plate fixed at a specified position of the stage while pushing the regulating plate to be in contact with said electronic parts, and positioning and regulating the electronic parts at the specified positions, and subsequently (e) a step of releasing the suction of the positioned and regulated electronic parts. Accordingly, the load is not concentrated when positioning and regulating the electronic part, and cooling of electronic part is prevented, and such outstanding effects are brought about.

The bump bonding method as set forth in claim 6 added

after application of the present case is characterized by moving of the electronic part on the moving track along the plurality of suction holes while being pushed to contact by means of the regulating plate. According to this method, suction error is prevented, and it is possible to move neatly on the moving track.

By contrast, in the bump forming method mentioned in the reference, the electronic part is positioned by two pairs of regulating pawls, that is, mutually confronting two X-gripping pieces (15, 15) and mutually confronting two Y-gripping pieces (16,16). All gripping pieces of the two pairs of regulating pawls (15, 15, 16, 16) operate to catch the electronic part. Further, at the positioned point, the electronic part is sucked powerfully.

Therefore, comparing the cited reference and claims 5 and 6 of the present application, the electronic part is positioned and regulated by four operating gripping pieces in the cited reference, while the electronic part is positioned and regulated at specified position by pressing the electronic part to the plate fixed at the specified position of the stage while pushing the regulating plate against the electronic part, in the present application.

That is, the reference tells nothing about the method in which "the electronic part is positioned and regulated by the fixed plate and the moving regulating plate," which

is a feature of the present application. Moreover, the reference mentions nothing about the method in which "the electronic part is positioned an regulated as being pressed to the fixed plate by moving along the moving track along the plurality of suction holes while being pushed by the regulating plate."

Therefore, the bump bonding method as set froth in claim 5 to claim 7 of the present application is not easily devised from the cited reference.

6. List of attached documents

(1) Procedure amendment, 1 copy