[Name of Document] Specification

[Title of the Invention] Adsorbing apparatus

[Technical Field]

[0001]

The present invention relates to an adsorbing apparatus for adsorbing an object to be adsorbed such as a semiconductor chip by vacuum suction, to thereby mount the object to be adsorbed onto a substrate such as a lead frame.

[Background Art]

[0002]

When the object to be adsorbed such as a semiconductor chip (hereinafter, referred to as "chip") is subjected to vacuum suction so as to be picked up, and pressure-bonded onto a specific substrate, an adsorbing apparatus is used. A general type of the adsorbing apparatus includes an elastic adsorbing member made of rubber, the elastic adsorbing member being held by a holder made of metal.

[0003]

In recent years, the chips are manufactured correspondingly to reduction in thickness thereof. For example, chips having a thickness of 10 μm to 20 μm are manufactured. Therefore, if a load is not evenly and uniformly applied to the chip when the adsorbing apparatus performs pressure bonding of an extremely-thin chip, the chip is easily warped. As a result, bonding force becomes uneven. Therefore, it is desirable to use an adsorbing member having a

horizontal adsorption surface.

[0004]

The adsorbing apparatus having the horizontal adsorption surface includes one as illustrated in FIG. 5 (Patent Document 1). The adsorbing apparatus of FIG. 5 includes an elastic adsorbing member 101 made of natural rubber, synthetic rubber, or the like, and a holder 102 made of metal. The elastic adsorbing member 101 is a rubber member in which a bottomed insertion hole 103 opened upward is formed. That is, the elastic adsorbing member 101 is constituted by a thick portion 104 formed on an outer peripheral side, and a thin portion 105 formed at a central portion, the thin portion 105 having a suction hole 109 extending therethrough in the upper and lower direction. The holder 102 is constituted by a shaft portion 106, a flange portion 107 coming into contact with an upper surface of the thick portion 104, and a protruding portion 108 insertion-fitted into the insertion hole 103, and a suction hole 110 extending therethrough in the upper and lower direction is formed in the shaft portion 106, the flange portion 107, and the protruding portion 108. In this case, the suction holes 109 and 110 are communicated to each other. Further, the protruding portion 108 of the holder 102 is inserted into the insertion hole 103, to thereby fix the elastic adsorbing member 101 and the holder 102 to each other.

[0005]

In the case of mounting the chip by using this adsorbing apparatus, a chip 120 is subjected to vacuum suction by the elastic adsorbing member 101. Further, as illustrated in FIG. 5, the chip 120 is moved onto a substrate 121 while being adsorbed, and the chip 120 is pressure-bonded onto the substrate 121 through the intermediation of an adhesive, a thermosetting resin film, or the like.

[0006]

Further, the adsorbing apparatus of another type includes one as illustrated in FIG. 6 (Patent Document 2). The adsorbing apparatus of FIG. 6 also includes an elastic adsorbing member 111 made of natural rubber, synthetic rubber, or the like, and a holder 112 made of metal. The elastic adsorbing member 111 is a rubber member having upper and lower surfaces parallel to each other, a predetermined thickness, and a rectangular-flat-plate shape. Around the elastic adsorbing member 111, there is formed a plurality of suction holes 113 extending through the elastic adsorbing member 111 in the upper and lower direction. The holder 112 includes a shaft portion 114, a flange portion 115 coming into contact with the upper surface of the elastic adsorbing member 111, and a brim portion 116 extending downward from the outer periphery of the flange portion 115, and, in the shaft portion 114 and the flange portion 115, there is formed a suction hole 117 extending therethrough in the upper and lower direction. Further, in the lower surface of

the flange portion 115, there are formed a communicating path 118 for communicating the suction holes 113 of the elastic adsorbing member 111 and the suction hole 117 of the holder 112. Further, the inner surface of the brim portion 116 is brought into pressure-contact with side walls of the elastic adsorbing member 111, to thereby fix the elastic adsorbing member 111 and the holder 112 to each other.

[Prior Art Document]

[Patent Document]

[0007]

[Patent Document 1] JP 2006-165188 A (FIG. 11)

[Patent Document 2] JP 64-10643 A

[Summary of the Invention]

[Problems to be solved by the Invention]

[0008]

However, in the adsorbing apparatus of the type disclosed in Patent Document 1, the elastic adsorbing member 101 is constituted by the thick portion 104 and the thin portion 105, and does not have a uniform thickness. As a result, at the time of mounting, when the elastic adsorbing member 101 pressurizes the chip 120, a difference in pressure is generated in the adsorption surface (lower surface of the elastic adsorbing member 101), which causes a problem of generation of uneven bonding force.

[0009]

Further, as in the case of the adsorbing apparatus of the type disclosed in Patent Document 2, when the holder 112 having the communicating path 118 formed in the lower surface of the flange portion 115 is used, the elastic adsorbing member 111 is warped to exhibit a shape protruding downward due to pressing force of the brim portion 116 with respect to the side walls of the elastic adsorbing member 111. Therefore, when the elastic adsorbing member 111 pressurizes the chip 120, there is exhibited a pressure distribution in which a strong pressure is applied at the central portion and a weak pressure is applied on the outer peripheral side, which results in nonuniform pressurization with respect to the chip 120. Therefore, there is a problem in that bonding force becomes uneven and it is impossible to perform bonding particularly at the outer peripheral side. In addition, the lower surface of the elastic adsorbing member 111 is warped, and hence adhesion properties at the time of adsorption between the elastic adsorbing member 111 and the chip 120 are deteriorated. Therefore, there is a problem also in that a gap is formed between a side of the adsorption surface of each of the suction holes 113 and the chip 120, and adsorbing force becomes insufficient.

[0010]

Further, in the adsorbing apparatus of the type disclosed in Patent Document 1, for fitting the protruding portion 108 and the insertion hole 103, it is necessary to process the protruding portion

108 and the insertion hole 103 so as to provide highly accurate dimensions. In the adsorbing apparatus disclosed in Patent Document 2, for fitting the brim portion 116 and the elastic adsorbing member 111, it is necessary to process the brim portion 116 and the elastic adsorbing member 111 so as to provide highly accurate dimensions. As a result, there arises a problem in that the manufacturing cost of the adsorbing member is increased.

[0011]

In view of the above-mentioned problems, the present invention provides an adsorbing apparatus capable of easily adsorbing an object to be adsorbed at the time of adsorption, applying stable bonding force to the object to be adsorbed at the time of bonding, and easily connecting an elastic adsorbing member and a holder to each other.

[Means for solving the Problems]

[0012]

An adsorbing apparatus of the present invention includes: an elastic adsorbing member which has a flat adsorption surface in which a vacuum suction port is formed, the elastic adsorbing member having a uniform thickness; and a holder for holding the elastic adsorbing member from a side of a reverse adsorption-surface, in which the holder includes a pin member protruding from a flat surface to a side of the adsorption surface, the flat surface coming into contact with the reverse adsorption-surface of the elastic adsorbing member, and the pin member is inserted into the elastic adsorbing

member, to thereby connect the elastic adsorbing member and the holder to each other.

[0013]

In the adsorbing apparatus of the present invention, the elastic adsorbing member has a flat adsorption surface, and a thickness in the upper and lower direction thereof is uniform. Further, the pin member protruding from the flat surface of the holder to the side of the adsorption surface is inserted into the elastic adsorbing member, to thereby connect the elastic adsorbing member and the holder to each other. As a result, the elastic adsorbing member is held from the reverse adsorption-surface. Therefore, the elastic adsorbing member does not receive an interior stress caused by bending or lateral compression, and hence it is possible to maintain the adsorption surface to be flat. Synergistically, when the object to be adsorbed is pressed to be mounted, the elastic adsorbing member is capable of applying load evenly and uniformly with respect to the object to be adsorbed. Further, when adsorbing the object to be adsorbed, no gap is formed between the side of the adsorption surface of the vacuum suction port and the object to be adsorbed, and hence the sufficient adsorbing force can be obtained.

[0014]

The elastic adsorbing member is provided with a vertical hole opened in the reverse adsorption-surface, and the pin member can

be inserted into the vertical hole. As a result, when being inserted into the elastic adsorbing member, the pin member can be inserted into the fixed position. Further, the pin member is inserted into the hole, and hence force required for insertion can be reduced.

[0015]

Before insertion of the pin member into the elastic adsorbing member, the vertical hole can be designed to have a diameter smaller than a diameter of the pin member. As a result, after the pin member is inserted into the elastic adsorbing member, the elastic adsorbing member comes into pressure-contact with the pin member.

[0016]

The pin member includes a plurality of pin members, and the plurality of pin members can be provided on the same circumference around a center of the flat surface of the holder, and can be arranged so that circumferential angles therebetween are equal to each other, the flat surface coming into contact with the reverse adsorption-surface of the elastic adsorbing member. As a result, the plurality of pin members can be arranged uniformly on the flat surface.

[0017]

The flat surface of the holder can be the same in size or larger than the reverse adsorption-surface of the elastic adsorbing member, the flat surface coming into contact with the reverse adsorption-surface of the elastic adsorbing member. As a result,

the holder is allowed to apply pressing force uniformly up to a peripheral edge portion of the elastic adsorbing member.

[0018]

The holder can be provided with a communicating path for communicating to the vacuum suction port of the elastic adsorbing member.

[Effects of the Invention]

[0019]

In the adsorbing apparatus of the present invention, when the object to be adsorbed is pressed to be mounted, the elastic adsorbing member is capable of applying load evenly and uniformly with respect to the object to be adsorbed. Therefore, at the time of bonding, it is possible to apply stable bonding force to the object to be adsorbed. Further, at the time of adsorption of the object to be adsorbed, no gap is formed between the side of the adsorption surface of the vacuum suction port and the object to be adsorbed. Therefore, sufficient adsorbing force can be obtained, and the object to be adsorbed can be easily adsorbed. Further, the pin member is inserted into the elastic adsorbing member, to thereby connect the elastic adsorbing member and the holder to each other. Therefore, the elastic adsorbing member and the holder can be easily connected and detached with respect to each other, which realizes excellent operability.

[0020]

When the pin member is inserted into the vertical hole of the

elastic adsorbing member, the elastic adsorbing member can be fixed at a fixed position with respect to the holder. Further, the pin member is inserted into the hole, and hence the force required for insertion can be reduced, thereby facilitating insertion of the pin member.

[0021]

Before insertion of the pin member into the elastic adsorbing member, when the diameter of the vertical hole is made smaller than the diameter of the pin member, the elastic adsorbing member comes into pressure-contact with the pin member. Therefore, it is possible to fixedly connect the elastic adsorbing member and the holder to each other, and hence it is possible to maintain the stable connection state for a long period of time. In addition, though fitting between the elastic adsorbing member and the holder depends on the diameter of the pin member and the hole diameter of the vertical hole, dimension errors are absorbed by elastic force of the elastic adsorbing member, and hence the hole diameter is not required to be highly accurate. As a result, highly accurate processing becomes unnecessary, and processing cost can be reduced.

[0022]

When the plurality of pin members are arranged on the same circumference around the center of the flat surface, and are arranged so that the circumferential angles therebetween are equal to each other, the plurality of pin members can be arranged uniformly on

the flat surface. Therefore, it is possible to further stably maintain the connection state between the elastic adsorbing member and the holder.

[0023]

When the flat surface of the holder is the same in size or larger than the reverse adsorption-surface of the elastic adsorbing member, the holder is capable of applying the pressing force up to the peripheral edge portion of the elastic adsorbing member. Therefore, it is possible to more effectively bond the object to be adsorbed up to the end portion.

[0024]

When the communicating path which communicates to the vacuum suction port is provided to the holder, the vacuum suction port can be arranged in the entire adsorption surface of the vacuum suction port, and the adsorbing force can be made uniform and larger. As a result, it is possible to perform stable adsorption.

[Brief Description of the Drawings]

[0025]

[FIG. 1] A sectional view of an adsorbing apparatus of the present invention.

[FIG. 2] A bottom view of a holder constituting the adsorbing apparatus of the present invention.

[FIG. 3] A plan view of an elastic adsorbing member constituting the adsorbing apparatus of the present invention.

[FIGS. 4] Diagrams of the adsorbing apparatus of the present invention, of which FIG. 4(a) is a sectional view of a chip before picking-up, FIG. 4(b) is a sectional view of the chip after the picking-up, and FIG. 4(c) is a sectional view at the time of mounting.

[FIG. 5] A sectional view of a conventional adsorbing apparatus.

[FIG. 6] A sectional view of another conventional adsorbing apparatus.

[Mode for carrying out the Invention]

[0026]

Hereinafter, the embodiment of the present invention is described with reference to FIGS. 1 to 4.

[0027]

An adsorbing apparatus of the present invention performs vacuum suction of an object to be adsorbed and carries the object to be adsorbed onto a mounted member so as to bond the object to be adsorbed to the mounted member through an adhesive, a thermosetting resin film, or the like. The object to be adsorbed is, for example, a deformable extremely-thin semiconductor chip (hereinafter, referred to as "chip"), which has a thickness of 10 to 20 μm and a square shape in this embodiment. The mounted member is, for example, a substrate such as a lead frame.

[0028]

As illustrated in FIG. 1, the adsorbing apparatus of the present

invention includes: an elastic adsorbing member 2 for adsorbing a chip 20 (see FIG. 4); and a holder 1 made of metal, for holding the elastic adsorbing member 2.

[0029]

As illustrated in FIG. 1, the holder 1 includes a shaft portion 3 and a flange portion 4, which comes into contact with the upper surface of the elastic adsorbing member 2. In the shaft portion 3, a suction hole 5 extending through the shaft portion 3 in the upper and lower direction is formed. Further, in the lower surface of the flange 4, a communicating path 6 as illustrated in FIG. 2 is formed. The communicating path 6 communicates to the suction hole 5 at the central portion thereof, and communicates to a vacuum suction ports 12, which are described later, of the elastic adsorbing member 2. Further, a flat surface (lower surface of the flange portion 4) coming into contact with a reverse adsorption-surface of the elastic adsorbing member 2 is made larger than the reverse adsorption surface of the elastic adsorbing member 2.

[0030]

On the lower surface of the flange 4, there are provided two pin members 7 protruding toward a side (lower side) of an adsorption surface. In this embodiment, the pin members 7 have front end edges formed as round portions, respectively. As illustrated in FIG. 2, two pin members 7 are respectively arranged at positions opposite to each other by 180° around the center of the lower surface of

the flange portion 4. The number of the pin members 7 may be three or more. In such case, the pin members 7 are arranged so that the pin members 7 exist on the same circumference around the center of the lower surface of the flange portion 4 and arranged so that circumferential angles between the pin members 7 are equal to each other (that is, 120°). In this manner, the pin members 7 are equally arranged. Therefore, even in the case of the two pin members 7, the pin members 7 are arranged so that they exist on the same circumference around the center of the lower surface of the flange portion 4 and so that the circumferential angles between the pin members 7 are equal to each other. Each of the pin members 7 is inserted into a vertical hole 11, which is described later, of the elastic adsorbing member 2. As a result, the holder 1 holds the upper surface of the elastic adsorbing member 2, to thereby connect the elastic adsorbing member 2 and the holder 1 to each other.

[0031]

The elastic adsorbing member 2 is a rubber member made of natural rubber or synthetic rubber. As illustrated in FIG. 1, the elastic adsorbing member 2 has a flat adsorption surface 10 at the lower surface thereof, and a thickness in the upper and lower direction of the elastic adsorbing member 2 is uniform. As illustrated in FIG. 3, in the reverse adsorption-surface (upper surface) of the elastic adsorbing member 2, there are formed two vertical holes 11, which is opened upward and closed downward. Those vertical holes

11 are arranged so that the pin members 7 match the respective vertical holes 11 when the lower surface of the flange portion 4 comes into contact with the reverse adsorption-surface (upper surface) of the elastic adsorbing member 2. That is, each of the vertical holes 11 is arranged so as to be equidistant around the center of the upper surface of the elastic adsorbing member 2, and so that the circumferential angles between the vertical holes 11 become substantially 180°. A hole diameter of the vertical holes 11 set to be smaller than a diameter of the pin members 7 before insertion of the pin members 7 into the elastic adsorbing member 2. As a result, after the pin members 7 are inserted into the elastic adsorbing member 2, the elastic adsorbing member 2 comes into pressure-contact with the pin members 7.

[0032]

In the elastic adsorbing member 2, there are formed four vacuum suction ports 12 extending therethrough in the upper and lower direction. As illustrated in FIG. 3, each of the vacuum suction ports 12 is provided in the substantially vicinity of the central portion of each of the four sides of the elastic adsorbing member 2. Those vacuum suction ports 12 are provided at portions corresponding to the upper and lower direction of the communicating path 6, and are communicated to the communicating path 6.

[0033]

Next, description is made of a method of mounting, by using

the adsorbing apparatus of the present invention, the chip at a pick-up position on the lead frame serving as the mounted member.

[0034]

First, as indicated by the arrow A of FIG. 4(a), the adsorbing apparatus is lowered toward the chip 20 on a stage 21 of the pick-up position, and the adsorption surface 10 of the elastic adsorbing member 2 is pressed against the upper surface of the chip 20, to thereby adsorb the chip 20. In this case, the adsorption surface 10 entirely comes into close contact with the upper surface of the chip 20. That is, the lower surface of the elastic adsorbing member 2 is the flat adsorption surface 10, and the thickness in the upper and lower direction of the elastic adsorbing member 2 is uniform. Further, the elastic adsorbing member 2 is held from the reverse adsorption-surface, and hence an interior stress caused by bending or lateral compression is not applied to the elastic adsorbing member. Therefore, the adsorption surface 10 can be maintained to be flat.

[0035]

In this state, when the suction hole 5 of the holder 1 is subjected to vacuuming, pressure in the vacuum suction ports 12 becomes negative through the intermediation of the communicating path 6. As a result, the chip 20 is subjected to vacuum suction. In this case, as described above, the adsorption surface 10 entirely comes into close contact with the upper surface of the chip 20. Therefore, when the chip 20 is adsorbed, no gap is formed between

a side of the lower surface of the vacuum suction ports 12 and the chip 20, and hence sufficient adsorbing force can be obtained.

[0036]

Further, as indicated by the arrow B of FIG. 4(b), the adsorbing apparatus is raised. In this manner, the chip 20 is picked up.

[0037]

Next, as indicated by the arrow C of FIG. 4(c), the adsorbing apparatus is lowered toward the lead frame 22 and pressed against the lead frame 22, to thereby perform pressure bonding. In this case, as described above, the adsorption surface 10 entirely comes into close contact with the upper surface of the chip 20, and hence the elastic adsorbing member 2 is capable of evenly and uniformly applying load to the chip 20. In addition, the lower surface of the flange portion 4 is larger than the upper surface of the elastic adsorbing member 2. Therefore, the holder 1 is capable of applying pressing force uniformly up to a peripheral edge portion of the elastic adsorbing member 2 and up to an end portion of the chip 20.

[0038]

In the present invention, the elastic adsorbing member 2 has a flat adsorption surface 10, and has a uniform thickness in the upper and lower direction. Further, the pin members 7 protruding from the flat surface of the holder 1 to the side of the adsorption surface are inserted into the elastic adsorbing member 2, to thereby

connect the elastic adsorbing member 2 and the holder 1. Therefore, by holding the elastic adsorbing member 2 from the reverse adsorption-surface, the interior stress caused by bending or lateral compression is not applied to the elastic adsorbing member 2, and hence the adsorption surface 10 can be maintained to be flat. Synergistically, when the chip 20 is pressed to be mounted, the elastic adsorbing member 2 is capable of evenly and uniformly applying load to the object to be adsorbed, and hence it is possible to give stable bonding force to the chip 20. Further, when the chip 20 is adsorbed, no gap is formed between the side of the adsorption surface of the vacuum suction ports 12 and the chip 20. As a result, the sufficient adsorbing force can be obtained, and hence it is possible to easily adsorb the chip 20. Further, the elastic adsorbing member 2 and the holder 1 are connected to each other by inserting the pin members 7 into the elastic adsorbing member 2, and hence the elastic adsorbing member 2 and the holder 1 can be easily connected and detached with respect to each other, which realizes excellent operability.

[0039]

In the elastic adsorbing member 2, the vertical holes 11 which are opened at least to the upper surface are provided, and the pin members 7 are inserted into the vertical holes 11. As a result, when being inserted into the elastic adsorbing member 2, the pin members 7 can be inserted into fixed positions. In addition, the

pin members 7 are inserted into the holes, and hence the force required for insertion can be reduced. Therefore, the pin members 7 can be easily inserted.

[0040]

Before insertion of the pin members 7 into the elastic adsorbing member 2, the diameter of the vertical holes 11 is set to be smaller than the diameter of the pin members 7. As a result, after the pin members 7 are inserted into the elastic adsorbing member 2, the elastic adsorbing member 2 comes into pressure-contact with the pin members 7. Therefore, the elastic adsorbing member 2 and the holder 1 can be fixedly connected to each other, and hence it is possible to maintain a stable connection state for a long period of time. In addition, though fitting between the elastic adsorbing member 2 and the holder 1 depends on the diameter of the pin members 7 and the hole diameter of the vertical holes 11, dimension errors are absorbed by the vertical holes 11, and hence the hole diameter is not required to be highly accurate. Therefore, highly accurate processing becomes unnecessary, and processing cost can be reduced.

[0041]

A plurality of the pin members 7 are provided, and the pin members 7 are provided on the same circumference around the center of the flat surface and arranged so that circumferential angles therebetween are equal to each other. As a result, the pin members 7 can be arranged equally on the flat surface, and hence the connection

state between the elastic adsorbing member 2 and the holder 1 can be further stably maintained.

[0042]

The flat surface of the holder 1 is the same in size or larger than the reverse adsorption surface of the elastic adsorbing member 2, the flat surface coming into contact with the reverse adsorption-surface of the elastic adsorbing member 2. As a result, the holder 1 is capable of equally applying the pressing force up to the peripheral edge portion of the elastic adsorbing member 2. Therefore, it is possible to more effectively bond the chip 20 up to the end portion.

[0043]

When the communicating path 6 communicating to the vacuum suction ports 12 is provided to the holder 1, it is possible to arrange the vacuum suction ports 12 in the entire surface of the adsorption surface 10, and the adsorbing force can be made uniform and larger. As a result, it is possible to perform stable adsorption.

[0044]

Though description is made above of the embodiment of the present invention, the present invention is not limited to the above-mentioned embodiment and can be modified variously. For example, the lower surface of the flange portion 4 may be the same in size as the reverse adsorption-surface of the elastic adsorbing member 2. The shape of the communicating path 6 is not limited to

the shape described in the embodiment, and may be a cross-shape, for example. The number of the pin members 7 is desirably two or four, but not limited to this number. Further, the length, diameter, material, and sectional shape of the pin members 7 can be set variously. The leading end of the pin members 7 may have a tapered portion. The vertical holes 11 may extend through the elastic adsorbing member 2 in the upper and lower direction, and the number thereof is, similarly to the pin members 7, arbitrary.

[Description of Reference Numerals]

[0045]

1	holder
2	elastic adsorbing member
6	communicating path
7	pin member
10	adsorption surface
11	vertical hole
12	vacuum suction port

[Name of Document] Scope of claims

1. An adsorbing apparatus, comprising:

an elastic adsorbing member which has a flat adsorption surface in which a vacuum suction port is formed, the elastic adsorbing member having a uniform thickness; and

a holder for holding the elastic adsorbing member from a side of a reverse adsorption-surface, wherein:

the holder comprises a pin member protruding from a flat surface to a side of the adsorption surface, the flat surface coming into contact with the reverse adsorption-surface of the elastic adsorbing member; and

the pin member is inserted into the elastic adsorbing member, to thereby connect the elastic adsorbing member and the holder to each other.

2. An adsorbing apparatus according to claim 1, wherein:

the elastic adsorbing member is provided with a vertical hole opened in the reverse adsorption-surface; and

the pin member is inserted into the vertical hole.

3. An adsorbing apparatus according to claim 2, wherein, before insertion of the pin member into the elastic adsorbing member, the vertical hole is designed to have a diameter smaller than a diameter of the pin member.

4. An adsorbing apparatus according to any one of claims 1 to 3, wherein:

the pin member comprises a plurality of pin members; and

the plurality of pin members are provided on the same circumference around a center of the flat surface of the holder, and are arranged so that circumferential angles therebetween are equal to each other, the flat surface coming into contact with the reverse adsorption-surface of the elastic adsorbing member.

5. An adsorbing apparatus according to any one of claims 1 to 4, wherein the flat surface of the holder is the same in size or larger than the reverse adsorption-surface of the elastic adsorbing member, the flat surface coming into contact with the reverse adsorption-surface of the elastic adsorbing member.

6. An adsorbing apparatus according to any one of claims 1 to 5, wherein the holder is provided with a communicating path communicating to the vacuum suction port of the elastic adsorbing member.