TITLE OF THE INVENTION

Electrode Forming Apparatus

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an electrode forming apparatus for applying electrode paste onto ends of chip type electronic components.

Description of the Background Art

In general, a holding plate having a number of receiving holes is employed for efficiently applying electrodes to end portions of a number of chip type electronic components, as disclosed in U.S. Patent No. 4,395,184. This holding plate comprises a hard substrate, a thin flat plate portion which is formed at a central portion of the substrate to be provided with a number of through holes, and a rubber-like elastic member which is embedded in a concave portion defined in the flat plate portion to be provided with receiving holes, passing through the elastic member, which are smaller in diameter than the through holes. The holding plate elastically holds chip type electronic components in the receiving holes to partially project the same, so that electrode paste of silver or the like is uniformly applied to the projected portions. Thereafter the chip type electronic components are heated to dry the electrode paste.

The aforementioned U.S. Patent describes an exemplary method of applying electrode paste to such chip type electronic components with a roller. In this method, a holding plate holding chip type electronic components to partially project the same from its upper surface is carried by a conveyor, and a roller which is coated with electrode paste on its peripheral surface is brought into contact with the projected portions of the chip type electronic components to apply the electrode paste onto the chip type electronic components. In order to uniformalize the thickness of the paste around the peripheral surface of the roller, a scraper is employed for scraping off excess part of the paste while rotating the roller.

When the chip type electronic components are about 1.6 to 5.7 mm in length, for example, the electrodes have extremely small thicknesses of about 0.15 to 0.3 mm, which must be controlled in high accuracy. In the aforementioned method, however, the paste which is applied to the peripheral surface of the roller flows following rotation thereof, and hence the thickness of the paste is finely varied to cause dispersion in thickness of the electrodes which are formed on the chip type electronic components. Such dispersion may also be caused by vibration of the conveyor or fluctuation of the degree of

horizontality.

Japanese Patent Publication No. 3-44404 (1991) describes a method of coating the upper surface of a flat coating plate with a thin film of electrode paste and approaching a holding plate holding chip type electronic components to partially downwardly project the same to the coating plate for pressing the projected portions of the chip type electronic components against the coating plate, thereby applying the electrode paste to the chip type electronic components. This method causes no such inconvenience as that in the aforementioned method employing a roller. According to this method, the projected portions of the chip type electronic components are pressed against the bottom surface of the coating plate which is coated with the paste, whereby the chip type electronic components are prevented from dispersion in length of the projected portions and the electrode widths are made uniform.

When a single application step is completed, however, the paste film is reduced in thickness in portions applied to the chip type electronic components. Therefore, it is necessary to temporarily collect the paste remaining on the coating plate to re-adjust the same to a constant thickness. Thus, much time is required for adjusting the film thickness, while it is difficult to adjust the paste

film to a constant thickness with high repeatability.

SUMMARY OF THE INVENTION

Accordingly, the present invention aims to provide an electrode forming apparatus, which can accurately adjust the film thickness of electrode paste with excellent repeatability, thereby carrying out homogeneous electrode application.

According to a first aspect of the invention, there is provided an electrode forming apparatus for applying electrodes onto ends of electronic components, said electrode forming apparatus including a dipping vessel having a horizontal bottom surface; means for gathering up electrode paste on the bottom surface of said dipping vessel towards a first end thereof; means for evenly spreading said gathered up electrode paste towards a second end of said vessel thereby forming an even thin film across the bottom surface of said vessel; and means for dipping said electronic components in said evenly spread then film of electrode paste.

More particularly, the present invention provides an electrode forming apparatus for pressing chip type electronic components, being held in receiving holes of a holding plate in partially projected downward states, against electrode paste which is coated on the bottom surface of a dipping vessel for applying electrodes onto ends of the chip type electronic components, which comprises a recovery blade for collecting the electrode paste on the bottom surface of the dipping vessel toward a first end of the dipping vessel, a levelling blade for levelling the electrode paste, collected toward the first end of the dipping vessel, toward a second end of the dipping vessel for adjusting the same to a constant thickness, driving means for effecting relative horizontally

reciprocating movement between the blades and the dipping vessel, first moving means for moving the recovery blade between a position in contact with the bottom surface of the dipping vessel and an upward retracted position, and second moving means for moving the levelling blade between a position close to the bottom surface of the dipping vessel and an upward retracted position.

The recovery blade and the levelling blade may be relatively horizontally reciprocated with respect to the dipping vessel. Thus, the dipping vessel may be set in a constant position so that the blades are reciprocated, or the blades may be set in constant positions so that the dipping vessel is reciprocated.

According to another aspect of the present invention, there is provided a method of forming electrodes on projecting portions of miniature components, said method comprising coating a horizontal bottom surface of a dipping vessel with a thin film of electrode paste, by injecting a prescribed amount of electrode paste into said vessel, gathering up said paste at one end of said vessel and spreading said gathered up paste towards another end of said vessel evenly over said surface; and dipping downward projecting portions of said components in said dipping vessel, thereby applying said electrode paste evenly to said projecting portions of said components.

More particularly, the present invention provides a method of forming electrodes on projected portions of miniature components, said method comprising:

coating a horizontal bottom surface of a dipping vessel with a thin film of electrode paste by injecting a prescribed amount of electrode paste into said vessel, scraping said surface from a first end to

a second end of the dipping vessel in order to substantially collect all the electrode paste at said second end, and levelling the collected paste by effecting relative movement between a levelling blade and the dipping vessel horizontally from said second end to said first end with said levelling blade located at a prescribed distance above said bottom surface;

engaging a holding plate holding downward projecting miniature components, by engaging means located in an engaging portion of a dipping apparatus;

moving the engaging means so as to bring the holding plate into pressure contact with the engaging portion of said dipping apparatus;

driving the engaging means vertically downwards such that the projecting portions of the chip type electronic components are dipped in the dipping vessel, thereby applying said electrode paste evenly to said projected portions of said components; and

moving the engaging portion vertically upwards, out of the dipping vessel.

According to an embodiment of the invention, the recovery and levelling blades are moved toward a first end of the dipping vessel, and a prescribed amount of electrode paste is injected into the dipping vessel. Then, the recovery blade is downwardly moved by the second vertical moving means to the position in constant with the bottom surface of the dipping vessel, while the recovery blade is horizontally moved by the driving means from the first end to a second end of the dipping vessel. The levelling blade, which is currently located in the upward retracted position, is horizontally moved integrally with the recovery blade. Since the recovery blade is moved toward the second end of the dipping vessel, the electrode paste

injected into the dipping vessel is substantially entirely collected toward

the second end. Then, the recovery blade is upwardly moved by the second vertical moving means, while the levelling blade is downwardly moved to the position close to the bottom surface of the dipping vessel. A clearance formed between the levelling blade and the bottom surface of the dipping vessel defines the film thickness of the electrode paste. In this state, the levelling blade is reversely horizontally moved from the second end toward the first end of the dipping vessel, thereby forming a paste film of a constant thickness on the bottom surface of the dipping vessel.

The first vertical moving means, which is simply adapted to bring the recovery blade into contact with the bottom surface of the dipping vessel, requires no high accuracy and may be formed by a direct actuator such as a cylinder. On the other hand, the second vertical moving means is preferably prepared from an accurate fine-controllable driving mechanism such as a mechanism including a stepping motor and a ball screw, since it is necessary to strictly set the clearance between the levelling blade and the dipping vessel.

According to the present invention, the recovery blade is first brought into contact with the bottom surface of the dipping vessel to collect the electrode paste toward the first end of the dipping vessel and then

the levelling blade is moved towards the bottom surface of the dipping vessel to level the electrode paste in a constant film thickness, whereby the electrode paste can be automatically collected and levelled. Thus, the electrode paste can be extremely easily adjusted to a constant film thickness with excellent repeatability. Consequently, it is possible to homogeneously apply electrodes onto ends of chip type electronic components.

The above and further features of the present invention are set forth with particularity in the appended claims and should become clearer from consideration of the following detailed description of embodiments of the present invention given with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front elevational view schematically showing an electrode forming apparatus according to an embodiment of the present invention;

Fig. 2 is a perspective view of a holding plate which is employed in the present invention;

Fig. 3 is a sectional view showing the holding plate holding chip type electronic components;

Fig. 4 is a plan view illustrating a dipping vessel and a blade portion;

Fig. 5 is a sectional view taken along the line V - V in Fig. 4;

Fig. 6 is a sectional view taken along the line VI - VI in Fig. 5;

Figs. 7(a) to 7(c) are explanatory diagrams for illustrating a method of applying paste;

Fig. 8 is an explanatory diagram showing a method of applying electrode paste onto chip type electronic components;

Fig. 9 is a sectional view showing an electrode forming apparatus according to another embodiment of the present invention; and

Fig. 10 is a sectional view taken along the line X - X in Fig. 9.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Fig. 1 shows an electrode forming apparatus according to an embodiment of the present invention, which is adapted to apply electrodes onto end portions of chip type electronic components B. As shown in Figs. 2 and 3, the chip type electronic components B are elastically held by a holding plate A to be partially projected from receiving holes a_1. The structure of this holding plate A is similar to that disclosed in Japanese Patent Publication No. 3-44404 (1991).

The inventive electrode forming apparatus is formed by a body 1, a dip head portion 2, a supply conveyor 5, a discharge conveyor 6, a dipping vessel 7, and a blade

portion 8. The body 1 contains a control unit (not shown) for controlling the operations of these elements.

The dip head portion 2 is fixed onto the body 1 through fixed poles 3, and a chucking portion 10 is vertically movably suspended from the lower part of the dip head portion 2 through a plurality of shafts 11. The dip head portion 2 contains vertical moving means (not shown), which is driven to vertically move the shafts 11, thereby vertically moving the chucking portion 10 in a horizontal state. The chucking portion 10 is provided on both horizontal sides with a pair of chucking pawls 12, which are horizontally opened and closed to chuck grooves a_2 provided on both sides of the holding plate A, being supplied by the conveyor 5.

Each of the supply and discharge conveyors 5 and 6 is formed by a pair of vertical halves. The lower half is provided with a sliding mechanism for sliding the upper half toward the center of the electrode forming apparatus, while the upper half is provided with a carriage mechanism for unidirectionally carrying the holding plate A. The upper halves of these conveyors 5 and 6 can be oppositely moved toward central positions, as shown by two-dot chain lines in Fig. 1.

The operations of the conveyors 5 and 6 and the chucking portion 10 are as follows:

First, the holding plate A is placed on the supply conveyor 5. This holding plate A holds the chip type electronic components B to downwardly project the same, as shown in Fig. 3. The upper-half of the supply conveyor 5 is slid toward the central position with the holding plate A, and the carriage mechanism contained therein is driven when the upper halves of the conveyors 5 and 6 are brought proximate to each other, so that the holding plate A is supported to extend across the two conveyors 5 and 6. Then, the chucking portion 10 is downwardly moved to chuck the holding plate A with the chucking pawls 12. Thereafter the upper halves of the conveyors 5 and 6 are retracted to the positions shown by solid lines. The chucking portion 10 is further downwardly moved to press the chip type electronic components, being held by the holding plate A, against the bottom surface of the dipping vessel 7, thereby applying electrodes onto the same. Thereafter the chucking portion 10 is upwardly moved to a position higher than the carriage level of the conveyors 5 and 6, which in turn are again moved to the positions shown by two-dot chain lines in Fig. 1, so that the holding plate A is supported across these conveyors 5 and 6. Thereafter the carriage mechanism contained in the conveyors 5 and 6 are driven to transfer the holding plate A onto the discharge conveyor 6, for carrying the same to

a subsequent stage.

The structures of the apparatus for moving the chucking portion 10 and the conveyors 5 and 6 are similar to those shown in Japanese Patent Application No. 3-347938 (1991).

Figs. 4 to 6 illustrate the structures of the dipping vessel 7 and the blade portion 8, which are principal parts of the present invention.

The dipping vessel 7 is in the form of a rectangular plate, which is slightly larger than the holding plate A, and provided with a pair of guide rails 20 on both sides of longer edges thereof. A blade supporting frame 21 is slidably supported on the guide rails 20 to horizontally extend across the dipping vessel 7. A recovery blade 22 for collecting electrode paste on an end portion of the dipping vessel 7 and a levelling blade 23 for adjusting the electrode paste in a prescribed thickness are mounted on the blade supporting frame 21 in independently vertically movable manners. The blades 22 and 23 have the same widths, which are slightly smaller than the inner width of the dipping vessel 7 along shorter edges. The recovery blade 22 is fixed to the lower surface of a bridge bar 24, which is vertically movably supported on the upper portion of the blade supporting frame 21. This bridge bar 24 is vertically driven by a pair of cylinders

25, which are provided on both end portions of the blade supporting frame 21. A rubber blade member 26 is mounted on the lower end of the recovery blade 22, to be brought into close contact with the bottom surface of the dipping vessel 7 thereby collecting the electrode paste.

On the other hand, a pair of blocks 27 are fixed to one side surface of the levelling blade 23, to be fitted with screw shafts 28 and slidably receive sliding shafts 30, whose upper end portions are fixed to a support plate 29. The screw shafts 28 rotatably pass through the support plate 29, and upper end portions thereof are driven by levelling control motors 31 through belts 46. Vertical cylinders 32 are fixed to horizontal end portions of the support plate 29, so that piston rods thereof are coupled to the blade supporting frame 21. Sliding shafts 33 are downwardly projected from both end portions of the support plate 29, to be vertically movably received in the blade supporting frame 21. Thus, whilst maintaining the support plate 29 in a horizontal orientation with respect to the blade support frame 21, it is possible to control coarse vertical movement of the support plate 21 by driving the vertical cylinders 32. In addition, it is possible to finely control the vertical position of the levelling blade 23 with respect to the support plate 29 by driving the levelling control motors 31. The lower limit position of the support plate 39 is set by boss portions

33a of the sliding shafts 33, whereby it is possible to precisely set the height of the levelling blade 23 from the bottom surface of the dipping vessel 7. In other words, it is possible to precisely control the thickness of the electrode paste which is applied to the bottom surface of the dipping vessel 7.

Four mounting holes 34, each of which has a circular end and another end having a T-shaped longitudinal section, are formed in the lower surface of the dipping vessel 7, while four headed pins 35, corresponding to the mounting holes 34, upwardly protrude from the body 1. The dipping vessel 7 is so placed on the body 1 that the circular portions of the mounting holes 34 receive the heads of the headed pins 35 and rightwardly slid in Fig. 4. Thus, the heads of the pins 35 are engaged in the T-shaped portions of the mounting holes 34, thereby locating the dipping vessel 7 with respect the body 1. The pins 35 are downwardly moved by a cylinder or the like, so that the dipping vessel 7 is held by the body 1 in a close contact manner.

A ball screw 36 is arranged at the back of the dipping vessel 7 in parallel with a longer edge thereof, to be fitted with a nut member 38, which is slidable along guide rails 37 provided on the body 1. An engaging member 39 having a handle 40 is provided on the nut member 38, to

be swingable about a shaft which is parallel to the ball screw 36. The engaging member 39 is driven by the handle 40 to swing toward the blade supporting frame 21, and is engaged with a receiving groove 41 which is formed in a rear end portion of the blade supporting frame 21, thereby coupling the nut member 38 with the blade supporting frame 21. A pulley 42 is mounted on a right side end of the ball screw 36. When the pulley 42 is driven by a motor 45 through a belt 43 and a pulley 44, the nut member 38 and the blade supporting frame 21 horizontally reciprocate in an integral manner.

An operation of the blade portion 8 is now described with reference to Figs. 7(a) to 7(c).

First, the blade member 26 of the recovery blade 22 is pressed against the bottom surface of the dipping vessel 7 and the blade supporting frame 21 is leftwardly driven as shown in Fig. 7(a), thereby leftwardly collecting the electrode paste P which is contained in the dipping vessel 7. Then, the recovery blade 22 is upwardly moved and the levelling blade 23 is moved towards the bottom surface of the dipping vessel 7, as shown in Fig. 7(b). At this time, a bank of the paste which is collected by the recovery blade 22 is formed in a position in front of the levelling blade 23. Then, the levelling blade 23 is rightwardly driven as shown in Fig. 7(c),

whereby a thin film Pm of the electrode paste is formed on the bottom surface of the dipping vessel 7 in correspondence to the clearance between the levelling blade 23 and the dipping vessel 7.

A method of applying electrodes to the projected portions of the chip type electronic components B held by the holding plate A with the dipping vessel 7, which is coated with the thin film Pm of electrode paste, is now described with reference to Fig. 8.

First, the forward ends of the chucking pawls 12 are inserted in the chucking grooves a_2 of the holding plate A holding the chip type electronic components B to downwardly project the same, and the chucking pawls 12 are moved up to bring the upper surface of the holding plate A into pressure contact with the chucking portion 10. The chucking portion 10 is previously strictly set to be in parallel with the bottom surface of the dipping vessel 7. The vertical moving means contained in the dip head portion 2 is driven to downwardly move the chucking portion 10 in a horizontal state. When the projected portions of the chip type electronic components B come into contact with the bottom surface of the dipping vessel 7, the chucking portion 10 is further slightly moved down to press the chip type electronic components B slightly into the receiving holes a_1. Thus, the projected portions

of the chip type electronic components B are corrected into constant lengths, to be provided with electrodes in uniform widths. At this time, the chucking pawls 12 are not in contact with the bottom surface of the dipping vessel 7 since the forward ends thereof are received in the chucking grooves a_2 of the holding plate A, and the dipping operation can be carried out with no hindrance.

Since a single holding plate A generally holds thousands of chip type electronic components B, strong reactive force acts on the holding plate A when the chip type electronic components B are pressed against the bottom surface of the dipping vessel 7, which is coated with the paste. However, deformation of the holding plate A is prevented and no dispersion is caused in electrode width since the upper surface of the holding plate A is surface-supported by the chucking portion 10. The chip type electronic components B may be pressed against the dipping vessel 7 a plurality of times, in order to improve accuracy of electrode widths.

When the engaging member 39 is disengaged from the receiving groove 41 and the mounting holes 34 formed in the bottom surface of the dipping vessel 7 are separated from the pins 35 provided on the body 1, the dipping vessel 7 can be simply replaced by another vessel. In other words, it is possible to replace the paste by

another type one without removing the paste adhering to the dipping vessel 7 and the blades 22 and 23, whereby the exchange time can be extremely reduced. Since the dipping vessel 7 and the blades 22 and 23 are integrally handled for changing the paste, no deviation is caused in positional relation which must be set in high accuracy between the bottom surface of the dipping vessel 7 and the levelling blade 23.

Although the levelling blade 23 is vertically moved by the vertical cylinder 32 and finely controlled by the levelling motor 31 in the aforementioned embodiment, the present invention is not restricted to this structure, but the levelling blade 23 may alternatively be driven by a stepping motor having high positional accuracy etc., to omit the fine control motor 31.

Figs. 9 and 10 illustrate another embodiment of the present invention, particularly in relation to a portion of a dipping vessel.

According to this embodiment, a recovery blade 64 and a levelling blade 65 are set in constant positions while a dipping vessel 50 is moved for levelling electrode paste, dissimilarly to the first embodiment.

The dipping vessel 50 is supported by a pair of sliding rails 52, which are set on a table 51, to be slidable perpendicularly to the plane of Fig. 9. A ball

screw 55 is horizontally arranged on a lower side of the dipping vessel 50 to be driven by a motor 53 through a belt 54, and a nut 56 is fixed to the lower surface of the dipping vessel 50 to be fitted with the ball screw 55. Thus, the ball screw 55 is rotated to horizontally slide the dipping vessel 50.

A planer type blade support frame 57 is provided on the table 51 to extend across the dipping vessel 50, while a pair of blade mounting bars 58 and 59 are mounted on the inner side of the blade support frame 57 by a pair of guide pins 60 and 61 respectively, to be vertically movable in horizontal states. The guide pins 60 and 61 pass through springs 62 and 63, which regularly upwardly urge the blade mounting bars 58 and 59. The recovery blade 64 and the levelling blade 65 are fixed to the lower surfaces of the blade mounting bars 58 and 59 respectively.

A pair of recovery blade lowering cylinders 66 are fixed to the upper surface of the blade support frame 57, so that rods 66a of the cylinders 66 are in contact with the upper surface of the blade mounting bar 58. Further, a pair of levelling blade lowering stepping motors 67 are fixed to the upper surface of the blade support frame 57 through brackets 68, while ball screws 69, which are driven by the stepping motors 67, are fitted with vertical

moving members 70. The ball screws 69 are rotatably supported by bearings 71 which are mounted on the brackets 68. Guide rails 72 are fixed to the brackets 68 in parallel with the ball screws 69, to slidably guide the vertical moving members 70. Pushers 73 are mounted on lower surfaces of first ends of the vertical moving members 70 to slidably pass through the blade support frame 57, and the lower ends of the pushers 73 are in contact with the upper surface of the blade mounting bar 59. Thus, the recovery blade 64 and the levelling blade 65 can be downwardly moved by the cylinders 66 and the stepping motors 67 respectively.

In order to collect electrode paste which is injected into the dipping vessel 50 toward a first end, the cylinders 66 are driven to press a blade member 64a, being provided in the lower end of the recovery blade 64, against the bottom surface of the dipping vessel 50, which in turn is slid by the motor 53 in this state. In order to adjust the collected electrode paste to a constant film thickness, on the other hand, the cylinders 66 are de-energized to upwardly move the recovery blade 64 by spring force of the spring 62, then the lower end of the levelling blade 65 is downwardly moved to a position close to the bottom surface of the dipping vessel 50 by the stepping motors 67, and the motor 53 is driven in this

state to reversely slide the dipping vessel 50.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.

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CLAIMS:

1. An electrode forming apparatus for applying electrodes onto ends of electronic components, said electrode forming apparatus including a dipping vessel having a horizontal bottom surface; means for gathering up electrode paste on the bottom surface of said dipping vessel towards a first end thereof; means for evenly spreading said gathered up electrode paste towards a second end of said vessel thereby forming an even thin film across the bottom surface of said vessel; and means for dipping said electronic components in said evenly spread thin film of electrode paste.

2. An electrode forming apparatus for pressing chip type electronic components, being held in receiving holes of a holding plate in partially projected downward states, against electrodes paste coated on the bottom surface of a dipping vessel thereby applying electrodes onto ends of said chip type electronic components, said electrode forming apparatus comprising:

a recovery blade for collecting said electrode paste on the bottom surface of said dipping vessel toward a first end of said dipping vessel;

a levelling blade for levelling said electrode

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paste, collected toward said first end of said dipping vessel, toward a second end of said dipping vessel for adjusting the same to a constant film thickness;

driving means for effecting relative horizontal reciprocating movement between said blades and said dipping vessel;

first moving means for moving said recovery blade between a position in contact with the bottom surface of said dipping vessel and an upward retracted position; and

second moving means for moving said levelling blade between a position close to the bottom surface of said dipping vessel and an upward retracted position.

3. An electrode forming apparatus in accordance with claim 2, wherein

said dipping vessel is set in a constant position in a horizontal state and provided with sliding means on both side portions,

a blade support frame, being slidable along said sliding means and being reciprocated by said driving means, is arranged to extend across said dipping vessel, and

said recovery blade and said levelling blade are mounted on said blade support frame through said first

moving means and said second moving means respectively.

4. An electrode forming apparatus in accordance with claim 2, wherein

said dipping vessel is slidable along horizontally set sliding means, and is reciprocated by said driving means, and

said recovery blade and said levelling blade are mounted on a blade support frame which is set in a constant position through said first moving means and said second moving means respectively.

5. An electrode forming apparatus according to any of claims 2 to 4, said apparatus further comprising:

a dip head portion; and

a chucking portion supported at a lower part of said dip head portion in a vertically movable manner through a plurality of shafts, said chucking portion being adapted to horizontally chuck said holding plate.

6. An electrode forming apparatus in accordance with claim 5, wherein said holding plate is provided in its side end surfaces with chucking grooves, and said chucking portion is provided with chucking pawls for

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engaging with said chucking grooves thereby surface supporting said holding plate.

7. An electrode forming apparatus in accordance with claim 5 or 6, further comprising:

supply and discharge conveyors provided on horizontal sides of said chucking portion and arranged to be flush with each other for supplying and discharging said holding plate to and from the position of said chucking portion.

8. An electrode forming apparatus in accordance with claim 7, wherein each of the supply and discharge conveyors is formed by a pair of vertical halves, the lower half being provided with a sliding mechanism for sliding the upper half toward the center of the electrode forming apparatus, and the upper half being provided with a carriage mechanism for unidirectionally carrying the holding plate.

9. An electrode forming apparatus in accordance with claim 7 or 8, wherein said supply and discharging conveyors are symmetrical in structure to each other.

10. A method of forming electrodes on projecting portions of miniature components, said method

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comprising coating a horizontal bottom surface of a dipping vessel with a thin film of electrode paste, by injecting a prescribed amount of electrode paste into said vessel, gathering up said paste at one end of said vessel and spreading said gathered up paste towards another end of said vessel evenly over said surface; and dipping downward projecting portions of said components in said dipping vessel, thereby applying said electrode paste evenly to said projecting portions of said components.

11. A method of forming electrodes on projected portions of miniature components, said method comprising:

coating a horizontal bottom surface of a dipping vessel with a thin film of electrode paste by injecting a prescribed amount of electrode paste into said vessel, scraping said surface from a first end to a second end of the dipping vessel in order to substantially collect all the electrode paste at said second end, and levelling the collected paste by effecting relative movement between a levelling blade and the dipping vessel horizontally from said second end to said first end with said levelling blade located at a prescribed distance above said bottom surface;

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engaging a holding plate holding downward projecting miniature components, by engaging means located in an engaging portion of a dipping apparatus;

moving the engaging means so as to bring the holding plate into pressure contact with the engaging portion of said dipping apparatus;

driving the engaging means vertically downwards such that the projecting portions of the chip type electronic components are dipped in the dipping vessel, thereby applying said electrode paste evenly to said projected portions of said components; and

moving the engaging portion vertically upwards, out of the dipping vessel.

12. An apparatus or method substantially as described herein with reference to the accompanying drawings.