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MANUFACTURING METHOD AND MANUFACTURING DEVICE

Abstract

A manufacturing method includes a resin layer forming step and a wire forming step repeatedly executed to form multiple terminal-attached resin layers each including a terminal portion connected to an electronic component, a mark pedestal formed by building up the resin layer in a mark formation area in the stage up to forming a resin layer of the terminal-attached resin layer, a reference mark is formed by discharging a first metallic fluid onto the mark pedestal in the wire forming step of forming the wire of the terminal-attached resin layer, and when the multiple terminal-attached resin layers are formed at positions of different heights, the mark pedestals corresponding to the heights of the multiple terminal-attached resin layers are formed in the mark formation area, and the reference marks are formed on multiple mark pedestals, respectively.

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Background/Summary

TECHNICAL FIELD

[0001] The present disclosure relates to a technology for manufacturing a board using a three-dimensional additive manufacturing.

BACKGROUND ART

[0002] Conventionally, various methods have been proposed as a manufacturing method of a board. For example, Patent Literature 1 below describes that a board is additively manufactured using a 3D printer. In the manufacturing method according to Patent Literature 1, multiple resin layers in which a wire and a reference mark are formed are formed by a 3D printer, and the multiple formed resin layers are built up layer by layer to manufacture a board. When the layers are built up layer by layer, the resin layers of the layers are positioned and built up with reference to center coordinates of the reference marks of a lower layer.

PRIOR ART LITERATURE

Patent Literature

[0003] Patent Literature 1: WO 2020/250381

BRIEF SUMMARY

Technical Problem

[0004] When an electronic component is mounted on a board after the above-described board is formed by the three-dimensional additive manufacturing, positional adjustment between an electrode of the electronic component and a terminal portion of a wire formed on a surface of the board is required. Further, multiple electronic components may be mounted on wires formed at different heights. In such a case, it is desirable that the position of each of the multiple electronic components connected to the terminal portions of the wires having different heights can be adjusted with high accuracy.

[0005] The present disclosure has been made in view of such circumstances, and an object of the present disclosure is to provide a manufacturing method and a manufacturing device that can manufacture a board that can improve the accuracy of positional adjustment between an electronic component and a terminal portion even in a case where heights at which multiple electronic components are mounted are different when forming a board by using a three-dimensional additive manufacturing.

Solution to Problem

[0006] In order to solve the above problems, the present disclosure discloses a manufacturing method including: a resin layer forming step of forming a resin layer by discharging a curable resin to a formation area in a stage: and a wire forming step of forming a wire by discharging a first metallic fluid containing metal fine particles on the resin layer, in which the resin layer forming step and the wire forming step are repeatedly executed to form multiple terminal-attached resin layers each including a terminal portion on a surface of the resin layer, the terminal portion being a part of the wire and connected to an electronic component to be mounted on the wire, a mark pedestal is formed by building up the resin layer in a mark formation area up to a resin layer forming step of forming a resin layer of the terminal-attached resin layer out of multiple resin layer forming steps, the mark formation area being an area different from the formation area in the stage, a reference mark is formed by discharging the first metallic fluid onto the mark pedestal in the wire forming step of forming the wire of the terminal-attached resin layer, and when the multiple terminal-attached resin layers are formed at positions of different heights, the mark pedestals corresponding to the heights of the multiple terminal-attached resin layers are formed in the mark

formation area, and the reference marks are formed on multiple mark pedestals, respectively.
[0007] In addition, the content of the present disclosure is not limited to implementation as the manufacturing method, and the present disclosure is also extremely effective to be implemented as a manufacturing device including a stage, a discharging device, and a control device.
Advantageous Effects
[0008] In the present disclosure, mark pedestals corresponding to the heights of the multiple terminal-attached insulating layers are formed, and a reference mark is formed on each of the multiple mark pedestals. When the electronic component is mounted on each of the terminal-attached insulating layers, the position can be adjusted using the reference mark on the mark pedestal corresponding to the height of each of the terminal-attached insulating layers. Accordingly, even when the heights at which the multiple electronic components are mounted are different from each other, it is possible to manufacture the board that can improve the accuracy of the positional adjustment between the electronic component and the terminal portion.

Description

BRIEF DESCRIPTION OF DRAWINGS
[0009] FIG. **1** is a view illustrating a board manufacturing device according to the present embodiment.
[0010] FIG. **2** is a block diagram of the board manufacturing device.
[0011] FIG. **3** is a plan view illustrating a region in a pallet.
[0012] FIG. **4** is a cross-sectional view illustrating a state in which a first-layer resin layer is formed.
[0013] FIG. **5** is a cross-sectional view illustrating a state in which a wire is formed on the first-layer resin layer.
[0014] FIG. **6** is a cross-sectional view illustrating a state in which a second-layer resin layer is formed.
[0015] FIG. **7** is a cross-sectional view of a board.
[0016] FIG. **8** is a plan view of a reference mark and a mark pedestal.
[0017] FIG. **9** is a side view of the reference mark and the mark pedestal.
[0018] FIG. **10** is a cross-sectional view of the board after an electronic component is mounted.
[0019] FIG. **11** is a cross-sectional view of a board after an electronic component of another example is mounted.
[0020] FIG. **12** is a plan view illustrating a region in a pallet of another example.
DESCRIPTION OF EMBODIMENTS
[0021] Hereinafter, a board manufacturing device as an embodiment of a manufacturing device of the present disclosure will be described with reference to the drawings. FIG. **1** illustrates board manufacturing device **10** according to the present embodiment. As illustrated in FIG. **1**, board manufacturing device **10** includes conveyance device **20**, first shaping unit **22**, second shaping unit **24**, third shaping unit **25**, mounting unit **27**, and control device **28** (see FIG. **2**). Board manufacturing device **10** is a device in which a board is additively manufactured using an inkjet method, and an electronic component is mounted on the shaped board by using three-dimensional additive manufacturing. The three-dimensional additive manufacturing used by board manufacturing device **10** is not limited to the inkjet method, and other additive manufacturing such as fused deposition modeling and selective laser sintering may also be used.
[0022] Conveyance device **20**, first shaping unit **22**, second shaping unit **24**, third shaping unit **25**, and mounting unit **27** are arranged on base **29** of board manufacturing device **10**. Base **29** generally has a rectangular shape. In the following description, as illustrated in FIG. **1**, a longitudinal direction of base **29** will be referred to as an X-axis direction, a transverse direction of base **29** will

be referred to as a Y-axis direction, and a direction orthogonal to both the X-axis direction and the Y-axis direction will be referred to as a Z-axis direction.

[0023] Conveyance device **20** includes X-axis slide mechanism **30** and Y-axis slide mechanism **32**. X-axis slide mechanism **30** includes X-axis slide rail **34** and X-axis slider **36**. X-axis slide rail **34** is provided on base **29** and is arranged along the X-axis direction. X-axis slider **36** is held by X-axis slide rail **34** to be slidable in the X-axis direction. X-axis slide mechanism **30** further includes electromagnetic motor **38** (refer to FIG. **2**), and moves X-axis slider **36** to any position in the X-axis direction by driving electromagnetic motor **38**.

[0024] In addition, Y-axis slide mechanism **32** includes Y-axis slide rail **50** and stage **52**. Y-axis slide rail **50** is provided on base **29** and is arranged along the Y-axis direction. One end portion (upper end in FIG. **1**) of Y-axis slide rail **50** is coupled to X-axis slider **36**. Thus, Y-axis slide mechanism **32** is movable in the X-axis direction together with X-axis slider **36**. Stage **52** is held by Y-axis slide rail **50** to be slidable in the Y-axis direction. Y-axis slide mechanism **32** has electromagnetic motor **56** (refer to FIG. **2**), and moves stage **52** to any position in the Y-axis direction by driving electromagnetic motor **56**. Thus, stage **52** can be moved to any position on base **29** in the X-axis direction and the Y-axis direction by the driving of X-axis slide mechanism **30** and Y-axis slide mechanism **32**.

[0025] Stage **52** includes base table **60**, holding device **62**, and lifting and lowering device **64**. Base table **60** is formed in a flat plate shape, and a board is placed on an upper surface thereof. Holding device **62** is provided on both side portions of base table **60** in the X-axis direction. For example, pallet **141** (see FIG. **3**) for shaping a board is arranged on base table **60**. Pallet **141** is, for example, a thin plate-shaped member made of metal. For example, release film **143** (see FIG. **3**) is attached onto pallet **141**, and a board is manufactured on release film **143**. Release film **143** is, for example, a film-shaped member whose adhesive strength is reduced by heat equal to or higher than a predetermined temperature, and is used to separate the board from pallet **141** after the board is manufactured. Pallet **141** is placed on base table **60** and is fixedly held with respect to base table **60** by sandwiching both edge portions in the X-axis direction via holding device **62**. Lifting and lowering device **64** is provided below base table **60** to lift and lower base table **60** in the Z-axis direction.

[0026] First shaping unit **22** is a unit for shaping a wire on base table **60** of stage **52**, and includes first print section **72** and sintering section **74**. First print section **72** includes inkjet head **76** (refer to FIG. **2**), and inkjet head **76** linearly discharges metal ink. The metal ink is ink obtained by dispersing nanometer-sized metal such as silver fine particles in an organic solvent. Surfaces of the metal fine particles are coated with, for example, a dispersing agent to prevent aggregation in the organic solvent. Additionally, inkjet head **76** discharges the metal ink from multiple nozzles through, for example, a piezoelectric method using a piezoelectric element.

[0027] Sintering section **74** includes infrared irradiation device **78** (refer to FIG. **2**). Infrared irradiation device **78** is, for example, an infrared heater, and is a device that irradiates and heats the discharged metal ink with infrared light. Based on the control of control device **28** (see FIG. **2**) of board manufacturing device **10**, infrared irradiation device **78** can be switched to, for example, a state of being heated to a first temperature and a state of being heated to a second temperature higher than the first temperature. For example, when the metal ink is heated by infrared irradiation device **78** of the first temperature, the organic solvent is vaporized and dried. When the metal ink is heated by infrared irradiation device **78** at the second temperature of high temperature, the metal ink is sintered to form a final wire. The sintering of the metal ink referred to herein means a phenomenon in which by applying thermal energy, an organic solvent is vaporized or a protective film of the metal fine particles, that is, a dispersing agent, is decomposed, and the metal fine particles are brought into contact with each other or fused to increase the conductivity. Board manufacturing device **10** executes, for example, drying at the first temperature on the discharged metal ink, and then executes the sintering at the second temperature to form a wire. The wire forming method is not limited to the above method. Control device **28** may execute the sintering via one heating without executing the drying step.

[0028] Second shaping unit **24** is a unit for shaping a resin layer on base table **60** of stage **52**, and includes second print section **84** and curing section **86**. Second print section **84** includes inkjet head **88** (refer to FIG. **2**). Inkjet head **88** discharges an ultraviolet curable resin. The ultraviolet curable resin is, for example, a resin that has an insulating property and that is cured by irradiation with an ultraviolet ray. A method by which inkjet head **88** discharges the ultraviolet curable resin may be, for example, a piezoelectric method using a piezoelectric element, or may be a thermal method in which a resin is heated to generate air bubbles and discharged from multiple nozzles.

[0029] Curing section **86** includes flattening device **90** (refer to FIG. **2**) and irradiation device **92** (refer to FIG. **2**). Flattening device **90** flattens an upper surface of the ultraviolet curable resin discharged by inkjet head **88**, and makes the thickness of the ultraviolet curable resin uniform by, for example, evening out the surface of the ultraviolet curable resin while scraping off an excess resin with a roller or a blade. Additionally, irradiation device **92** includes a mercury lamp or an LED as a light source and irradiates the discharged ultraviolet curable resin with ultraviolet rays. Thus, the discharged ultraviolet curable resin is cured to form a resin layer having an insulating property.

[0030] Third shaping unit **25** is a unit for shaping a connection section connecting the electrode of the electronic component and the terminal portion of the wire on base table **60**, and includes third print section **100** and first heating section **102**. Third print section **100** includes dispenser **106** (see FIG. **2**). Dispenser **106** discharges a conductive resin paste. The conductive resin paste is, for example, a resin that is cured by heating at a relatively low temperature, in which micrometer-sized metal particles (such as silver particles) are dispersed. The metal particle is, for example, flake-like. The viscosity of the conductive resin paste is, for example, higher than that of the metal ink.

[0031] First heating section **102** includes, for example, pair of heating plates **108** (see FIG. **2**) facing each other in the Z-axis direction. Pair of heating plates **108** is a device that heats the conductive resin paste applied from dispenser **106**. For example, the board which is a manufacturing target is heated by being sandwiched between pair of heating plates **108** after the conductive resin paste is discharged onto the terminal portions of the wire. In the conductive resin paste, the resin is cured by the heating and bonded to the terminal portion. Next, the electronic component is mounted on the board, and the electrode of the electronic component is arranged on the conductive resin paste bonded to the terminal portion. Then, in a state where the electrode of the electronic component is arranged on the terminal portion via the conductive resin paste, the board is heated while being sandwiched by pair of heating plates **108**. In the conductive resin paste, the resin is cured by the heating to shrink, and the flaky metal particles dispersed in the resin come into contact with each other. As a result, the conductive resin paste exhibits conductivity. The electronic component is electrically connected to the terminal portion via the conductive resin paste. The resin of the conductive resin paste is an organic adhesive, exerts an adhesive force by being cured by heating, and physically bonds the terminal portion (wire) and the electrode.

[0032] The above-described method of heating the metal ink and the conductive resin paste is an example. For example, the conductive resin paste may be heated using an infrared heater. Alternatively, the metal ink may be sintered using heating plate **108**. In addition, board manufacturing device **10** may include a heating unit other than infrared irradiation device **78** and heating plate **108**, for example, an electric furnace that heats the manufacturing object in a furnace.

[0033] Mounting unit **27** includes supply section **120** and mounting section **122**. Supply section **120** is a device that supplies electronic components to be mounted on a board, and includes, for example, tape feeder **124**. Tape feeder **124** supplies the electronic component to a supply position from a carrier tape in which the electronic component is taped. The method of supplying the electronic component is not limited to the method using tape feeder **124**, and may be, for example, a method using a tray-type supply device that supplies electronic components arranged on a tray.

Supply section **120** can supply probe pins. The probe pin is formed of a metal such as copper or gold, and is used for, for example, an electrical connection between a wire of a certain layer and a wire of another layer. Alternatively, the probe pin is used for electrical connection between a certain board and another board. The method of supplying the probe pins is not particularly limited, but for example, the probe pins may be arranged on a tray and supplied.

[0034] Mounting section **122** includes mounting head **126** (refer to FIG. **2**) and movement device **128** (refer to FIG. **2**). Mounting head **126** includes a suction nozzle (not illustrated) for picking up and holding the electronic component. The suction nozzle picks up and holds the electronic component by suctioning air through the supply of a negative pressure from a positive and negative pressure supply device (not illustrated). The suction nozzle is separated from the electronic component by supplying a slight positive pressure from the positive and negative pressure supply device. In addition, movement device **128** moves mounting head **126** between the supply position of tape feeder **124** and the board placed on base table **60**. Mounting section **122** drives movement device **128** to hold the electronic component supplied from tape feeder **124** on the suction nozzle of mounting head **126**, and mounts the electronic component held by mounting head **126** on the board.

[0035] FIG. **2** is a block diagram of board manufacturing device **10**. As illustrated in FIG. **2**, control device **28** includes controller **130**, multiple drive circuits **132**, storage device **133**, and external interface (IF) **135**. Controller **130** includes a CPU, mainly includes a computer, and is connected to multiple drive circuits **132**. Multiple drive circuits **132** is an amplifier of a motor or the like, and is connected to above-described electromagnetic motors **38** and **56**, holding device **62**, lifting and lowering device **64**, inkjet head **76**, infrared irradiation device **78**, inkjet head **88**, flattening device **90**, irradiation device **92**, dispenser **106**, heating plate **108**, tape feeder **124**, mounting head **126**, and movement device **128**. Storage device **133** includes, for example, RAM, ROM, a flash memory, HDD, and the like. Storage device **133** stores control program **133**A. Controller **130** executes control program **133**A via the CPU, and controls the operations of conveyance device **20**, first shaping unit **22**, second shaping unit **24**, third shaping unit **25**, and mounting unit **27** via drive circuits **132**. In the following description, control device **28** that executes control program **133**A in controller **130** may be simply referred to as a device name. For example, “control device **28** controls X-axis slide mechanism **30**” means that control device **28** executes control program **133**A via the CPU of controller **130** and controls X-axis slide mechanism **30** via drive circuit **132**.

[0036] External IF **135** is, for example, a LANIF, and is connected to first management device **138** and second management device **139** via local network **137**. First management device **138** is, for example, a device that generates and stores three-dimensional data of a manufacturing object (board or the like) to be additively manufactured by an inkjet method. Control device **28** stores three-dimensional data **133**B acquired from first management device **138** in storage device **133**, controls first shaping unit **22** and the like based on three-dimensional data **133**B, and executes manufacturing of the board. Three-dimensional data **133**B includes, for example, data obtained by slicing board **161** (see FIG. **9**), which is a manufacturing object, for each layer. Three-dimensional data **133**B includes data of each layer for manufacturing reference mark M and mark pedestal **173** (see FIG. **9**) to be described later. The three-dimensional data of board **161**, reference mark M, and mark pedestal **173** may be separate data.

[0037] Second management device **139** is a device that generates and stores job data (control data, a so-called recipe) used in a mounting process of mounting electronic components on a manufactured board. Control device **28** stores job data **133**C acquired from second management device **139** in storage device **133**, and determines the type of electronic component to be mounted and the mounting position based on job data **133**C, and controls mounting unit **27**. The configuration illustrated in FIG. **2** is an example. First management device **138** that generates three-dimensional data **133**B and second management device **139** that generates job data **133**C may be the same device. Board manufacturing device **10** may have a function of generating three-dimensional data **133**B and job data **133**C.

[0038] In board manufacturing device **10** of the present embodiment, multiple resin layers are built up layer by layer on base table **60** by the above-described configuration, and wires are appropriately formed in each resin layer. Further, board manufacturing device **10** connects the electrodes of the electronic components to the terminal portions of the wires through the conductive resin paste to manufacture the board on which the electronic components are mounted. In addition, board manufacturing device **10** executes correction using the reference mark in order to adjust the position where the conductive resin paste is discharged and to adjust the position where the electronic component is mounted. This reference mark is a so-called fiducial mark. Board manufacturing device **10** also shapes the fiducial mark by using an inkjet method.

[0039] Specifically, FIG. **3** is a plan view illustrating a region in pallet **141** arranged on base table **60**. As illustrated in FIG. **3**, pallet **141** is, for example, a metal plate member having a rectangular shape in plan view. In a state where pallet **141** is placed on base table **60**, pallet **141** is arranged in a state in which the longitudinal direction thereof is along the X-axis direction. Both ends of pallet **141** in the X-axis direction are held by holding device **62**. The shape, arrangement, number, and the like of the regions illustrated in FIG. **3** are merely examples.

[0040] Release film **143** is attached onto pallet **141**. For example, control device **28** sets formation area **145** in release film **143**, and manufactures a board in formation area **145**. Formation area **145** is, for example, a square region in plan view, and is set at the center of pallet **141**. First waste ejection area **147** is set on one side (upper side in FIG. **3**) of formation area **145** in the X-axis direction. When ink (metal ink or the like) is discharged from inkjet heads **76** and **88** in the cleaning of the nozzle or the like, control device **28** executes ink discharge in first waste ejection area **147**. In addition, second waste ejection area **148** is set on a side (lower side in FIG. **3**) opposite to first waste ejection area **147** across formation area **145** in the X-axis direction. In the case of discharging ink (conductive resin paste) from dispenser **106** in cleaning of dispenser **106** or the like, control device **28** discharges the ink to second waste ejection area **148**. Temperature sensor measurement area **149** is set on one side (right side in FIG. **3**) of formation area **145** in the Y-axis direction. Temperature sensor measurement area **149** is a region for measuring the temperature of release film **143** in order to confirm whether the temperature of release film **143** has reached the peeling temperature. The temperature measurement of release film **143** may be executed by control device **28** using a temperature sensor or by a person by hand work.

[0041] Further, mark formation areas **150** and **151** are provided on both sides of formation area **145** in the X-axis direction. Mark formation area **150** is set, for example, between first waste ejection area **147** and formation area **145** in the X-axis direction. Mark formation area **151** is set, for example, outside formation area **145** in the X-axis direction and on both sides of second waste ejection area **148** in the Y-axis direction. Reference mark M is formed in each of pair of mark formation areas **150** and **151**. Reference mark M will be described in detail later.

[0042] Next, an example of a board manufacturing step will be described. FIGS. **4** to **6** illustrate a state in which the resin layer and the wire are shaped. In the following description, a case of manufacturing five-layer board **161** illustrated in FIG. **9** will be described as an example. First, control device **28** causes X-axis slide mechanism **30** and Y-axis slide mechanism **32** to move stage **52** below second shaping unit **24**. Control device **28** causes second shaping unit **24** to discharge the ultraviolet curable resin in a thin film shape from inkjet head **88** of second print section **84** to the upper surface of release film **143** of stage **52**. Control device **28** causes the ultraviolet curable resin to be discharged to a position based on three-dimensional data **133**B of the manufacturing target. For example, control device **28** causes flattening device **90** of curing section **86** to flatten the ultraviolet curable resin discharged in a thin film shape so that the thin film becomes uniform. In addition, for example, control device **28** may further discharge the ultraviolet curable resin onto the flattened ultraviolet curable resin to be semi-cured, and may smooth the unevenness of the surface generated by the flattening by using the leveling effect of the semi-cured ultraviolet curable resin.

[0043] Control device **28** causes irradiation device **92** to irradiate and cure the ultraviolet curable resin that has been flattened or smoothed with ultraviolet rays. Thereby, as illustrated in FIG. **4**, thin film resin layer **163** is formed on release film **143** (in formation area **145** illustrated in FIG. **3**). For example, control device **28** further discharges the ultraviolet curable resin onto thin film resin layer **163**, and repeatedly executes flattening, smoothing, and curing. Thus, as illustrated in FIG. **4**, first-layer resin layer **165** is formed on release film **143** by building up thin film resin layer **163**. It is to be noted that control device **28** may execute flattening or the like each time scanning of the ultraviolet curable resin is executed multiple times without executing flattening, smoothing, and curing each time the ultraviolet curable resin is discharged.
[0044] Next, control device **28** causes X-axis slide mechanism **30** and Y-axis slide mechanism **32** to move stage **52** below first shaping unit **22**. Control device **28** causes first shaping unit **22** to discharge the metal ink from inkjet head **76** of first print section **72** onto the upper surface of resin layer **165**. Control device **28** causes the metal ink to be discharged to a position based on the circuit pattern set in three-dimensional data **133**B. Next, control device **28** causes sintering section **74** of first shaping unit **22** to irradiate the discharged metal ink with infrared light from infrared irradiation device **78**. For example, after discharging the metal ink in one scan, control device **28** sets infrared irradiation device **78** to the first temperature and heats the discharged metal ink. As a result, a part of the organic solvent is vaporized and dried in the metal ink. When the discharge and the drying are executed repeatedly and building-up is executed by a desired thickness, control device **28** sets infrared irradiation device **78** to the second temperature higher than the first temperature, and executes sintering of the built-up metal ink. Thus, as illustrated in FIG. **5**, wire **167** having the predetermined thickness and the wire pattern set in three-dimensional data **133**B is formed on resin layer **165**.
[0045] Next, control device **28** moves stage **52** below second shaping unit **24**. Similarly to first-layer resin layer **165**, control device **28** repeatedly executes discharging, flattening, smoothing, and curing of the ultraviolet curable resin, and forms second-layer resin layer **165** on first-layer resin layer **165**. Second-layer resin layer **165** is formed to cover wire **167** on first-layer resin layer **165**. Further, as illustrated in FIG. **6**, control device **28** forms cavity **169** for exposing a part of first-layer wire **167** in second-layer resin layer **165**. A part of wire **167** exposed in cavity **169** functions as terminal portion **167**A on which electronic component **181** (see FIG. **9**) is mounted. For example, control device **28** further discharges the metal ink onto first-layer wire **167**, and forms interlayer wire (via) **171** that connects first-layer wire **167** to upper-layer wire **167** at any position in second-layer resin layer **165**. The connection of wires **167** of different layers may be executed using probe pins **183** (see FIG. **9**) without using interlayer wire **171**.
[0046] Control device **28** repeatedly executes the step of forming resin layer **165** and the step of forming wire **167** to manufacture five-layer board **161** illustrated in FIG. **7**. In the following description, each layer of board **161** is referred to as a first layer, second layer, third layer, . . . , and fifth layer in order from the bottom. As illustrated in FIG. **7**, board **161** has resin layer **165** (hereinafter, may be referred to as a terminal-attached resin layer) provided with terminal portion **167**A on a surface thereof. In the example illustrated in FIG. **7**, all of the first to fifth layers are the terminal-attached resin layers. Cavity **169** on which electronic component **181** (see FIG. **10**) is mounted is formed in the terminal-attached resin layer of each layer.
[0047] Here, board manufacturing device **10** can execute the steps up to the mounting of electronic component **181** in the same device. As electronic component **181** to be mounted, various types of electronic components **181** that can be supplied from supply section **120** can be used. Different types of electronic components **181** may have different connected circuit configurations, and the number of layers (mounting height) of the circuits also differs. That is, the number of layers of wire **167** and resin layer **165** to be built up and formed below the position where electronic component **181** is mounted differs. In other words, in the case where the terminal-attached resin layer provided with terminal portion **167**A connected to electronic component **181** on the surface is multiple layers

on board **161** that is shaped by being built up, the heights of the multiple terminal-attached resin layers are different from each other. The height of the terminal-attached resin layer varies for various reasons, including the type of electronic component **181**, the size of electronic component **181**, the number of electrodes of electronic component **181**, the overall shape of the shaped object to be manufactured, or the like.

[0048] Meanwhile, in the three-dimensional additive manufacturing using the resin as in the present embodiment, for example, there is a possibility that the ultraviolet curable resin is shrunk by the curing treatment of the ultraviolet curable resin using ultraviolet rays. Further, there is a possibility that the ultraviolet curable resin shrinks due to heat generated in the process of curing the metal ink or the conductive resin paste. As a result, the positions of terminal portions **167**A of the terminal-attached resin layers may be slightly displaced depending on the number of layers below. Then, in the manufacturing step of board **161**, control device **28** additively manufactures mark pedestal **173** having the same height as the terminal-attached resin layer in parallel, and forms reference mark M on mark pedestal **173**.

[0049] In the example illustrated in FIG. **7**, terminal portion **167**A is formed in each of the five layers. That is, electronic component **181** is mounted on all five terminal-attached insulating layers (see FIG. **10**). In this case, control device **28** forms mark pedestal **173** having a height corresponding to each of the five layers, and forms reference mark M on each of the five types of mark pedestals **173**. In the following description, when reference marks M corresponding to the respective layers of the first layer to fifth layer are distinguished from each other, the number of layers are added after the reference marks as reference marks M**1**, M**2**, M**3**, M**4**, and M**5**. When reference marks M**1** to M**5** are collectively referred to, reference marks M**1** to M**5** are referred to as reference mark M.

[0050] As illustrated in FIG. **4**, for example, in the resin layer forming step of forming first-layer resin layer **165**, control device **28** forms the first layer of mark pedestal **173** in each of mark formation areas **150** and **151**. Control device **28** forms the first layer of mark pedestal **173** in parallel with resin layer **165** in the same procedure as the procedure of forming resin layer **165** of formation area **145**. More specifically, each procedure of discharging, flattening, smoothing, and curing by ultraviolet rays of the ultraviolet curable resin when resin layer **165** is formed is performed in the same procedure, and a first layer of mark pedestal **173** is formed with an ultraviolet curable resin. For example, in a case where the ultraviolet curable resin is discharged by inkjet head **88** in order to shape thin film resin layer **163** of a certain layer, control device **28** discharges the ultraviolet curable resin to formation area **145** and also to mark formation areas **150** and **151**. That is, thin film resin layer **163** having the same height as resin layer **165** and mark pedestal **173** is shaped in parallel. Further, for example, in the case of flattening the discharged ultraviolet curable resin, control device **28** also flattens the ultraviolet curable resin in formation area **145** via the rollers of flattening device **90**, and also flattens the ultraviolet curable resin in mark formation areas **150** and **151**. Control device **28** forms the first layer of mark pedestal **173** on reference marks M**1** to M**5**. Control device **28** does not have to form resin layer **165** and mark pedestal **173** in parallel. For example, after forming one layer of resin layer **165** in formation area **145**, control device **28** may form the first layer of mark pedestal **173** in mark formation areas **150** and **151**.

[0051] As illustrated in FIG. **5**, for example, in the wire forming step of forming wire **167** on first-layer resin layer **165**, control device **28** forms reference mark M**1** on mark pedestal **173** for reference mark M**1**. Control device **28** forms reference mark M**1** in the same procedure as the procedure of forming wire **167** in formation area **145** and in parallel with wire **167**. More specifically, the procedures of the discharging, the drying, and the sintering of the metal ink when forming wire **167** are performed in the same procedure in the shaping of reference mark M**1**, and reference mark M**1** is formed with the metal ink. For example, when the metal ink is discharged by inkjet head **76** in order to shape wire **167**, control device **28** causes the metal ink to be discharged to mark formation areas **150** and **151** while discharging the metal ink to formation area **145**. Control device **28** does not shape reference mark M at this stage for mark pedestal **173** for other reference marks M**2** to M**5**.

[0052] In the resin layer forming step of forming resin layer **165** of each layer, control device **28** executes the above-described step of forming mark pedestal **173**. Mark pedestals **173** of reference marks M**1** to M**5** are built up in this order. In the wire forming step of forming wire **167** of each layer, control device **28** forms reference mark M corresponding to the height (in the same layer). For example, control device **28** forms reference mark M**2** in the wire forming step of second-layer wire **167**, and forms reference mark M**3** in the wire forming step of third-layer wire **167**. Therefore, in the case of manufacturing board **161** illustrated in FIG. **10**, five types of mark pedestals **173** and reference marks M**1** to M**5** corresponding to the five layers from the first layer to fifth layer are formed.

[0053] FIG. **8** is a plan view when reference marks M of the five layers are formed, and illustrates reference marks M on the upper side (first waste ejection area **147** side) in FIG. **3**. FIG. **9** illustrates a side view when reference mark M is formed, and illustrates reference mark M on the upper side (first waste ejection area **147** side) in FIG. **3**. As illustrated in FIGS. **3**, **8**, and **9**, for example, control device **28** forms each of reference marks M**1** to M**5** along a direction parallel to the Y-axis direction in each of mark formation areas **150** and **151**. In the example of FIG. **3**, in mark formation area **150**, control device **28** forms the first layer, second layer, and third layer of reference marks M**1**, M**2**, and M**3** on a first side (left side in FIG. **3**) in the Y-axis direction, and the fourth layer and fifth layer of reference marks M**4** and M**5** on a second side. Further, in mark formation area **151**, control device **28** forms the fourth layer and fifth layer of reference marks M**4** and M**5** on the first side (left side in FIG. **3**) in the Y-axis direction, and the first layer, second layer, and third layer of reference marks M**1**, M**2**, and M**3** on the second side. Reference marks M of mark formation areas **150** and **151** have the same distance between pair of reference marks M of the respective layers. More specifically, as illustrated in FIG. **3**, for example, distance **175** between pair of reference marks M**1** formed in mark formation areas **150** and **151** is the same as distance **176** between pair of reference marks M**2**. Similarly, for other layers, the distance between pair of reference marks M corresponding to a certain layer is the same as the distance between pair of reference marks M corresponding to another layer.

[0054] Further, as illustrated in FIGS. **8** and **9**, respective mark pedestals **173** of reference marks M**1** to M**5** are increased by one layer in this order. In FIG. **9**, a broken line is illustrated at the boundary portion for the sake of convenience so that respective mark pedestals **173** of reference marks M**1** to M**5** can be distinguished. That is, the mark pedestal in the present disclosure is, for example, a portion corresponding to a lower resin layer built up to form certain reference mark M.

[0055] Further, mark pedestals **173** of adjacent reference marks M**1** to M**3** are connected to each other, and mark pedestals **173** of the adjacent reference marks M**4** and M**5** are also connected to each other. Mark pedestals **173** of adjacent reference marks M may be separated from each other. Reference mark M has a circular shape in plan view illustrated in FIG. **8**, for example. The thickness of reference mark M along the Z-axis direction is the same as the thickness of wire **167**. The thickness of reference mark M may be different from the thickness of wire **167**. For example, reference mark M may be thinner than wire **167**. In this case, in the formation of reference mark M, the number of layers built up may be reduced compared to the step of forming wire **167**.

[0056] Control device **28** uses reference mark M of each layer formed in parallel with the manufacture of board **161** to correct the position at which the conductive resin paste is discharged, the position at which electrode **181**A of electronic component **181** is arranged, and the position at which probe pin **183** is arranged. Specifically, as illustrated in FIG. **7**, for example, after forming five layers of board **161**, control device **28** discharges conductive resin paste **177** to terminal portion **167**A of each layer. Control device **28** moves stage **52** below third shaping unit **25**. Control device **28** causes third print section **100** of third shaping unit **25** to discharge conductive resin paste

177 from dispenser **106** onto terminal portion **167**A exposed in cavity **169**. Further, control device **28** causes conductive resin paste **177** to be discharged from dispenser **106** onto terminal portion **167**A of wire **167** exposed in insertion hole **179** into which probe pin **183** (see FIG. **10**) is inserted.
[0057] Control device **28** executes correction using reference mark M in adjustment of the position where conductive resin paste **177** is discharged. Specifically, control device **28** executes the discharging of conductive resin paste **177** in the order of, for example, the first layer, the second layer, . . . , and the fifth layer. When discharging conductive resin paste **177** to terminal portion **167**A provided on first-layer resin layer **165**, control device **28** executes correction using reference mark M**1** of each of mark formation areas **150** and **151**. A known method can be adopted as the correction processing. For example, control device **28** detects the center position (center of a circle) of reference mark M**1** of mark formation area **150** and the center position of reference mark M**1** of mark formation area **151**. Control device **28** detects the position of terminal portion **167**A for discharging conductive resin paste **177**. As a method of detecting the center position and the position of terminal portion **167**A, for example, a method of making detection based on image data obtained by imaging reference mark M**1** and terminal portion **167**A with a camera attached into board manufacturing device **10** can be adopted. The attaching position of the camera is not particularly limited, but may be, for example, attached to dispenser **106** or mounting head **126**. For example, the discharge position of conductive resin paste **177** of each layer is set in three-dimensional data **133**B. Control device **28** detects an error between the position (the actual position) of terminal portion **167**A and the discharge position (the position of the setting data) based on the center position of two reference marks M**1** and the position of terminal portion **167**A, and corrects the discharge position.
[0058] As described above, up to the resin layer forming step of forming resin layer **165** of a certain terminal-attached resin layer, control device **28** forms mark pedestal **173** in the same procedure as the procedure of forming resin layer **165** of formation area **145** and in parallel with resin layer **165** of formation area **145**, and forms mark pedestal **173** having the same height as the terminal-attached resin layer. In the wire forming step of forming wire **167** of the terminal-attached resin layer, control device **28** forms reference mark M in the same procedure as the procedure of forming wire **167** and in parallel with wire **167**. Accordingly, correction using reference mark M and mark pedestal **173** formed in the same procedure as the target member (terminal portion **167**A and resin layer **165** below terminal portion **167**A) for position adjustment can be executed. In other words, by shaping in the same manner, the same change (shrinkage of resin or the like) as resin layer **165** and wire **167** can be reproduced on reference mark M and mark pedestal **173**. Therefore, the correction of the discharge position of conductive resin paste **177** and the correction of the arrangement position of electronic component **181** described later can be executed with high accuracy using reference mark M.
[0059] Control device **28** executes the same correction as that for the first layer in discharging conductive resin paste **177** in resin layer **165** positioned above the second layer. Specifically, when adjusting the position where conductive resin paste **177** is discharged to second-layer terminal portion **167**A, control device **28** executes correction using pair of reference marks M**2**. Further, for example, when adjusting the position where conductive resin paste **177** is discharged to terminal portion **167**A of fifth-layer, control device **28** executes correction using pair of reference marks M**5**. Control device **28** need not discharge conductive resin paste **177** in order for each layer. For example, in a plan view of board **161**, control device **28** may discharge conductive resin paste **177** in order from terminal portion **167**A closer to any corner in the X-axis direction and the Y-axis direction.
[0060] In accordance with the adjustment of the position where conductive resin paste **177** is discharged, control device **28** executes correction using reference mark M on mark pedestal **173** having the same height as the terminal-attached resin layer on which electronic component **181** to be bonded by conductive resin paste **177** to be discharged is mounted. According to this, even when

the error due to shrinkage or the like of the resin is different in each layer, conductive resin paste **177** can be accurately discharged to terminal portion **167**A of each layer.

[0061] When the discharge of conductive resin paste **177** is completed, control device **28** heats conductive resin paste **177** via first heating section **102**. For example, control device **28** arranges pallet **141** on which board **161** is placed between pair of heating plates **108** facing each other in the Z-axis direction, and heats conductive resin paste **177** via heating plate **108**. Accordingly, conductive resin paste **177** is bonded to terminal portion **167**A in cavity **169** and terminal portion **167**A in insertion hole **179**. The work of arranging pallet **141** between pair of heating plates **108** may be executed by a machine using, for example, a robot or a conveyor device, or may be performed by a person by hand work.

[0062] Next, control device **28** moves stage **52** on which board **161** is placed to mounting unit **27**. Control device **28** causes mounting unit **27** to mount electronic component **181**. Control device **28** supplies any electronic component **181** from tape feeder **124** to the supply position, and arranges electronic component **181** on conductive resin paste **177** of board **161** via the suction nozzle of mounting head **126**. Control device **28** causes movement device **128** of mounting section **122** to arrange electronic component **181** held by mounting head **126** in cavity **169**. At this time, control device **28** arranges electronic component **181** such that electrode **181**A of electronic component **181** is in contact with conductive resin paste **177** discharged onto terminal portion **167**A. Electrode **181**A of electronic component **181** is a lead or a ball.

[0063] Control device **28** also executes correction using reference mark M even in the adjustment of the position where above-described electronic component **181** is arranged. Control device **28** controls mounting unit **27** based on job data **133**C. For example, in job data **133**C, the XYZ coordinates of the position at which electronic component **181** is mounted are set, and the XYZ coordinates are set by grouping electronic components **181** into each layer. When mounting electronic component **181** having one layer, control device **28** executes mounting using data of the group of one layer. Similarly to the above-described discharge position of conductive resin paste **177**, control device **28** corrects the error between the position (actual position) of conductive resin paste **177** and the position (coordinates of the setting data) set in job data **133**C, for example, based on the center position of reference mark M and the position of conductive resin paste **177** (terminal portion **167**A) on which electronic component **181** is mounted. When the correction and mounting are completed for all electronic components **181** mounted on the first layer, control device **28** starts mounting the second layer. Control device **28** uses reference mark M**1** for the position correction of electronic component **181** to be mounted on the first layer, and uses reference mark M**2** for the position correction of electronic component **181** to be mounted on the second layer. Control device **28** executes the processing in the order of the first layer, the second layer, . . . , and the fifth layer, and executes the correction using reference mark M on mark pedestal **173** having the same height in the mounting of each layer.

[0064] In accordance with the mounting step of mounting electronic component **181** on terminal portion **167**A, control device **28** corrects the position where electronic component **181** is mounted on terminal portion **167**A by using reference mark M provided on mark pedestal **173** having the same height as the terminal-attached resin layer on which electronic component **181** is mounted. According to this, even when an error due to shrinkage or the like of the resin is different for each layer, electronic component **181** can be accurately mounted by using mark pedestal **173** and reference mark M corresponding to each layer.

[0065] In addition, after the mounting of all electronic components **181** is completed for a certain layer, for example, for mounting of the first layer to the fifth layer, control device **28** starts mounting of electronic component **181** of the next layer. Accordingly, control device **28** selects a terminal-attached resin layer on which electronic component **181** is to be mounted out of the multiple terminal-attached resin layers, executes correction using reference mark M, mounts all of electronic components **181** to be mounted on the selected terminal-attached resin layer, and then executes mounting to another terminal-attached resin layer. Accordingly, electronic components **181** to be corrected using same reference mark M**1** can be collectively mounted. Since correction using different reference mark M is not required each time electronic component **181** is mounted, electronic component **181** can be mounted efficiently.

[0066] When the mounting of electronic component **181** is completed for all of the five layers, control device **28** executes mounting of probe pin **183**. Control device **28** causes mounting unit **27** to insert probe pin **183** held by the suction nozzle of mounting section **122** into insertion hole **179**. At this time, control device **28** arranges probe pin **183** such that the lower end of probe pin **183** comes into contact with conductive resin paste **177** discharged onto terminal portion **167**A. Control device **28** also executes correction using reference mark M even in the adjustment of the position where probe pin **183** is arranged. As in the case of electronic component **181**, for example, when probe pin **183** is mounted on the fifth layer, control device **28** corrects the position at which probe pin **183** is arranged using reference mark M**5**, and arranges probe pin **183**. Thus, probe pins **183** can be accurately arranged in conductive resin paste **177**. Control device **28** may mount probe pin **183** before electronic component **181** is mounted.

[0067] As illustrated in FIG. **10**, when the arrangement of electronic component **181** and probe pin **183** is completed, control device **28** moves stage **52** to first heating section **102** to heat conductive resin paste **177**. For example, in a state in which electronic component **181** and probe pin **183** are arranged on terminal portion **167**A via conductive resin paste **177**, control device **28** heats board **161** while sandwiching board **161** from both sides in the Z-axis direction via pair of heating plates **108**. In conductive resin paste **177**, the resin is cured, and electrode **181**A of electronic component **181** and terminal portion **167**A, or probe pin **183** and terminal portion **167**A are electrically connected. Thus, a desired shaped object can be manufactured. The peeling temperature of release film **143** is set to, for example, the final heating temperature of above-described conductive resin paste **177**. Therefore, when the heating of conductive resin paste **177** is completed, release film **143** is partially or entirely peeled from pallet **141** or board **161**. Accordingly, the user can easily take out completed board **161** from stage **52**.

[0068] In the embodiment, board manufacturing device **10** is an example of a manufacturing device. Inkjet heads **76** and **88** and dispenser **106** are examples of a discharging device. The ultraviolet curable resin is an example of a curable resin. The metal ink is an example of a first metallic fluid. Conductive resin paste **177** is an example of a second metallic fluid. The steps of FIGS. **4** and **6** are examples of a resin layer forming step and a resin layer forming process. The step of FIG. **5** is an example of a wire forming step and a wire forming process. FIG. **9** is an example of a mounting step.

[0069] Hereinbefore, according to the embodiment, the following effects are achieved.

[0070] Control device **28** of one aspect of the present embodiment forms mark pedestal **173** by building up resin layer **165** in mark formation areas **150** and **151** up to the resin layer forming step of forming resin layer **165** of the terminal-attached resin layer. In the wire forming step of forming wire **167** of the terminal-attached resin layer, control device **28** forms reference mark M on mark pedestal **173**. Then, control device **28** forms mark pedestals **173** corresponding to the heights of the multiple terminal-attached resin layers in mark formation areas **150** and **151**, respectively, and forms reference marks M**1** to M**5** on multiple mark pedestals **173**. As a result, it is possible to form mark pedestal **173** in which resin layer **165** is built up to the same height as the terminal-attached resin layer, and to provide reference mark M thereon. The shrinkage or the like of the resin generated in the terminal-attached insulating layer or lower resin layer **165** can be generated (recreated) similarly to mark pedestal **173**. Therefore, by using reference mark M on mark pedestal **173** formed in the same manner as the terminal-attached resin layer, it is possible to execute the correction in consideration of the shrinkage of the resin or the like, and to execute the position correction with high accuracy.

[0071] The present disclosure is not limited to the above-described embodiment, but can be performed in various forms in which various changes and improvements are made based on the knowledge of those skilled in the art.

[0072] For example, in the above embodiment, electronic component **181** is mounted on all the layers of five-layer board **161**. That is, in the above embodiment, all the layers are the terminal-attached insulating layers; however, the configuration is not limited to this. For example, as in board **161**A illustrated in FIG. **11**, electronic components **181** may be mounted only in the third layer, the fourth layer, and the fifth layer. In the case of board **161**A, the third layer, the fourth layer, and the fifth layer are terminal-attached resin layers. Control device **28** forms only reference marks M**3**, M**4**, and M**5** corresponding to the third layer to fifth layer, and executes correction using reference marks M**3** to M**5**. Note that control device **28** may form all of reference marks M**1** to M**5** in the manufacture of board **161**A of the terminal-attached resin layer in the third layer to fifth layer.

[0073] Board **161** is not limited to five layers, and may be two or more layers.

[0074] The arrangement of reference marks M illustrated in FIG. **3** is an example. For example, as illustrated in FIG. **12**, three reference marks M may be provided for one layer. Then, control device **28** may execute correction using three reference marks M when adjusting the position at which conductive resin paste **177** is discharged in each layer, the position at which electronic component **181** is arranged, and the position at which probe pin **183** is arranged. Only one reference mark M may be provided for one layer, or four or more reference marks M may be provided for one layer. Accordingly, the number of mark formation areas may be one or three or more.

[0075] The formation procedures of mark pedestal **173** and resin layer **165** need not be the same. For example, in the formation of mark pedestal **173**, flattening and smoothing may be omitted.

[0076] The procedure of forming reference mark M and wire **167** need not be the same. For example, the thickness of reference mark M may be thinner or thicker than wire **167**.

[0077] Although board manufacturing device **10** includes mounting unit **27** and is configured to execute the process until mounting electronic component **181**, mounting unit **27** need not be included. In this case, board manufacturing device **10** may execute manufacturing up to manufacturing of board **161** (board **161** in the state of FIG. **7** or the like) before electronic component **181** is mounted. Further, the mounting of electronic component **181** may be executed by another device.

[0078] Control device **28** may use reference mark M to correct the position of at least one of the discharge position of conductive resin paste **177**, the arrangement position of electronic component **181**, and the arrangement position of probe pin **183**.

[0079] For electronic component **181** of each layer, control device **28** sequentially executes mounting of electronic component **181** from the lower layer as, after the mounting of all electronic components **181** of the first layer is completed, control device **28** mounts electronic components **181** of the second layer and then mounts electronic components **181** of the third layer.: however, the configuration is not limited to this. For example, control device **28** may mount electronic component **181** in order of the fifth layer, the fourth layer, . . . , and the first layer, and may execute the mounting in any order such as the second layer, the fourth layer, the third layer, the fifth layer, and the first layer. Control device **28** does not necessarily need to collectively mount electronic components **181** of each layer. Control device **28** may mount first electronic component **181** of the first layer, then mount first electronic component **181** of the second layer, and then mount second electronic component **181** of the first layer again. For example, control device **28** may mount electronic components **181** in order from electronic component **181** closer to any corner in the X-axis direction and the Y-axis direction in a plan view of board **161**.

[0080] In addition, the curable resin of the present disclosure is not limited to the ultraviolet curable resin, and various resins that are cured by light, heat, or the like can be used.

[0081] It should be noted that the content of the present disclosure is not limited to the dependent relationships described in the claims.

REFERENCE SIGNS LIST

[0082] **10**: board manufacturing device (manufacturing device), **28**: control device, **52**: stage, **76**, **88**: inkjet head (discharging device), **106**: dispenser (discharging device), **145**: formation area, **150**, **151**: mark formation area, **165**: resin layer, **167**: wire, **167**A: terminal portion, **173**: mark pedestal, **177**: conductive resin paste (second metallic fluid), **181**: electronic component, **181**A: electrode, M, M**1** to M**5**: reference mark.

Claims

1. A manufacturing method comprising: a resin layer forming step of forming a resin layer by discharging a curable resin to a formation area in a stage; and a wire forming step of forming a wire by discharging a first metallic fluid containing metal fine particles on the resin layer, wherein the resin layer forming step and the wire forming step are repeatedly executed to form multiple terminal-attached resin layers each including a terminal portion on a surface of the resin layer, the terminal portion being a part of the wire and connected to an electronic component to be mounted on the wire, a mark pedestal is formed by building up the resin layer in a mark formation area up to a resin layer forming step of forming a resin layer of the terminal-attached resin layer out of multiple resin layer forming steps, the mark formation area being an area different from the formation area in the stage, a reference mark is formed by discharging the first metallic fluid onto the mark pedestal in the wire forming step of forming the wire of the terminal-attached resin layer, and when the multiple terminal-attached resin layers are formed at positions of different heights, the mark pedestals corresponding to the heights of the multiple terminal-attached resin layers are formed in the mark formation area, and the reference marks are formed on multiple mark pedestals, respectively.

2. The manufacturing method according to claim 1, wherein up to the end of the resin layer forming step of forming the resin layer of the terminal-attached resin layer, the mark pedestal is formed in the same procedure as a procedure of forming the resin layer of the formation area and in parallel with forming the resin layer of the formation area, and the mark pedestal is formed at the same height as the terminal-attached resin layer, and in the wire forming step of forming the wire of the terminal-attached resin layer, the reference mark is formed in the same procedure as a procedure of forming the wire and in parallel with forming the wire.

3. The manufacturing method according to claim 1, further comprising: a mounting step of mounting the electronic component on the terminal portion of the terminal-attached resin layer, wherein, in the mounting step, correction of a position at which the electronic component is mounted on the terminal portion is executed using the reference mark provided on the mark pedestal having the same height as the terminal-attached resin layer on which the electronic component is to be mounted.

4. The manufacturing method according to claim 3, wherein in the mounting step, a second metallic fluid that connects an electrode of the electronic component and the terminal portion is discharged to the terminal portion, and in adjustment of a position at which the second metallic fluid is discharged, correction using the reference mark provided on the mark pedestal having the same height as the terminal-attached resin layer on which the electronic component is to be mounted is executed.

5. The manufacturing method according to claim 3, wherein when the mounting step is executed for each of the multiple terminal-attached resin layers, the terminal-attached resin layer on which the mounting step is executed is selected out of the multiple terminal-attached resin layers, correction using the reference mark is executed, all of the electronic components to be mounted on the selected terminal-attached resin layer are mounted, and then the mounting step of other terminal-attached resin layers is executed.

6. A manufacturing device comprising: a stage; a discharging device; and a control device, wherein the control device includes: a resin layer forming process of forming a resin layer by discharging a curable resin to a formation area in the stage using the discharging device; and a wire forming process of forming a wire by discharging a first metallic fluid containing metal fine particles on the resin layer using the discharging device, executes the resin layer forming process and the wire forming process repeatedly to form multiple terminal-attached resin layers each including a terminal portion on a surface of the resin layer, the terminal portion being a part of the wire and connected to an electronic component to be mounted on the wire, forms a mark pedestal by building up the resin layer in a mark formation area up to a resin layer forming process of forming a resin layer of the terminal-attached resin layer out of multiple resin layer forming processes, the mark formation area being an area different from the formation area in the stage, forms a reference mark by discharging the first metallic fluid onto the mark pedestal using the discharging device in the wire forming process of forming the wire of the terminal-attached resin layer, and when the multiple terminal-attached resin layers are formed at positions of different heights, forms the mark pedestals corresponding to the heights of the multiple terminal-attached resin layers in the mark formation area, and forms the reference marks on multiple mark pedestals, respectively.