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Material transferring apparatus for battery manufacturing

Abstract

A material transferring apparatus for battery manufacturing includes a support unit having a support region for supporting a moving object and having a first contact surface, a moving unit having a second contact surface in contact with the support unit and moving the support unit, and coupling units provided on the support unit and the moving unit, respectively, and contacting each other before the first contact surface and the second contact surface come into contact with each other.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION(S)

(1) This application claims benefit of priority to Korean Patent Application No. 10-2022-0007639 filed on Jan. 19, 2022 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

1. Field

(2) The present disclosure relates to a material transferring apparatus for battery manufacturing.

2. Description of Related Art

(3) Secondary batteries are widely used not only in small electronic devices such as mobile phones and laptops, but also in medium and large-sized mechanical devices such as electric vehicles (EVs), and have the advantage of being rechargeable and reusable.

(4) Such a secondary battery may be manufactured by accommodating an electrode assembly composed of a positive electrode plate, a negative electrode plate, and a separator in a case, injecting an electrolyte into the case and then sealing the case.

(5) The secondary battery manufacturing process may be largely divided into an electrode process of manufacturing positive and negative plates, an assembly process of forming an electrode assembly with a positive electrode plate, a negative electrode plate, and a separator and impregnating the electrode assembly with an electrolyte, and a formation process of imparting electrical properties to the electrode assembly and testing performance.

(6) Materials required for secondary battery manufacturing may become a final product, a battery, through these processes step by step. Therefore, it may be very important to rapidly move the materials required for battery manufacturing or partially completed semi-finished products to respective processes to improve battery manufacturing efficiency.

SUMMARY

(7) An aspect of the present disclosure is to improve battery manufacturing efficiency.

(8) An aspect of the present disclosure is to automate a battery manufacturing process and improve the convenience of manufacturing operations.

(9) According to an aspect of the present disclosure, a material transferring apparatus for battery manufacturing includes a support unit having a support region for supporting an object and having a first contact surface; a moving unit having a second contact surface in contact with the support unit and moving the support unit; and coupling units provided on the support unit and the moving unit, respectively, and contacting each other before the first contact surface and the second contact surface come into contact with each other.

(10) The coupling unit may be maintained in a state of being in contact with each other while the first contact surface and the second contact surface are in contact with each other.

(11) The support unit may include a support frame having the support region; and a guide frame connected to the support unit and disposed at the periphery of the support region to contact the object. The guide frame may be provided to vary an area of the support region.

(12) The guide frame may include a fixed side frame fixed to the support frame and contacting the moving unit; a guide member connected to the support frame and extending in a thickness direction of the object to contact a side surface of the object; and a moving side frame connected to the guide member and the fixed side frame and extending in a longitudinal direction or a width direction of the object. The moving side frame may be provided such that a position connected to the fixed side frame and the guide member is varied.

(13) The coupling unit may include a first coupling unit provided in a region facing the fixed side frame in the moving unit; and a second coupling unit provided in a region facing the moving unit in the fixed side frame. The first coupling unit and the second coupling unit may be provided to be in contact with each other before the moving unit and the fixed side frame come into contact, and may be maintained in a state of being in contact with each other while the moving unit contacts the fixed

side frame.

- (14) The first coupling unit may include at least one coupling protrusion protruding from the moving unit toward the fixed side frame, and the second coupling unit may include at least one coupling groove, which is formed in the fixed side frame and into which the coupling protrusion is inserted.
- (15) The coupling protrusion and the fixed side frame may include a material containing a magnetic material.
- (16) The coupling protrusion may include a curved region sliding in the coupling groove.
- (17) The coupling groove may include a section inclined with respect to the longitudinal direction of the object.
- (18) The moving unit may include at least one mobile robot arm in contact with the fixed side frame. The at least one mobile robot arm may include a first bent extension portion formed by bending and extending an end thereof in a direction of the fixed side frame. The fixed side frame may include a second bent extension portion formed by bending and extending an end thereof in a direction of the at least one mobile robot arm and contacting the first bent extension portion. The first bent extension portion may be present below the second bending extension portion in a direction of gravity, while the at least one mobile robot arm moves the support unit.
- (19) A plurality of the fixed side frames may be disposed to face each other in the support frame and may include one or more first gap adjustment holes, a plurality of the moving side frames may be disposed to face each other in the support frame and include one or more second gap adjustment holes, and a plurality of the guide members may be disposed to face the first gap adjustment hole and the second gap adjustment hole.
- (20) The support unit may further include one or more first fixing members inserted into the one or more first gap adjustment holes, ends of the one or more first fixing members being in contact with the guide member; and a plurality of second fixing members inserted into the one or more second gap adjustment holes, ends of the plurality of second fixing member being in contact with the guide member.
- (21) The support frame may include a plurality of first fastening holes spaced apart from each other in the longitudinal direction and the width direction of the object; and a plurality of second fastening holes spaced apart from each other in the width direction of the object. The fixed side frame may include a plurality of third fastening holes facing the plurality of second fastening holes, the guide member may include a fourth fastening hole opposite to the plurality of first fastening holes, and the plurality of first fastening holes, the plurality of second fastening holes, the plurality of third fastening holes and the fourth fastening hole may be provided with a fastening member inserted thereinto.
- (22) The fastening member may include a first fastening member inserted into the plurality of second fastening holes and the plurality of third fastening holes to fix the fixed side frame to the support frame; and a second fastening member inserted into the plurality of first fastening holes and the fourth fastening hole to fix the guide member to the support frame.
- (23) A plurality of the fixed side frames may be spaced apart from each other in the longitudinal direction or the width direction of the object, a plurality of the mobile robot arms may be in contact with the plurality of fixed side frames in a state in which ends thereof are spaced apart from each other by a first length, and a plurality of the fixed side frames may be fixed to the support frame in such a manner that surfaces in contact with the plurality of mobile robot arms are spaced apart by the first length.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) The above and other aspects, features, and advantages of the present disclosure will be more clearly understood from the following detailed description, taken in conjunction with the accompanying drawings, in which:

- (2) FIG. 1 is a perspective view of a material transferring apparatus for battery manufacturing according to an embodiment;
- (3) FIG. 2 is a plan view partially illustrating a material transferring apparatus for battery manufacturing according to an embodiment;
- (4) FIG. 3 is a plan view partially illustrating a material transferring apparatus for battery manufacturing according to an embodiment;
- (5) FIG. 4 is a front view partially illustrating a material transferring apparatus for battery manufacturing according to another embodiment;
- (6) FIG. 5 is a view illustrating a state in which a coupling protrusion is inserted into a coupling groove in the state of FIG. 4;
- (7) FIG. 6 is a perspective view of a support unit according to an embodiment;
- (8) FIG. 7 is an exploded perspective view of a support unit according to an embodiment; and
- (9) FIG. 8 is a perspective view of a support unit according to another embodiment.

DETAILED DESCRIPTION

(10) Hereinafter, in order to help the understanding of the description of the embodiment, elements described with the same reference numerals in the accompanying drawings are the same elements, and in respective embodiments, related components among components performing the same action are indicated by the same or similar numbers.

(11) In addition, to clarify the gist of the present disclosure, descriptions of elements and techniques well known by the prior art will be omitted, and the present disclosure will be described in detail below with reference to the accompanying drawings.

(12) However, the spirit of the present disclosure is not limited to the presented embodiment, and specific components may be proposed in other forms in which specific elements are added, changed, or deleted by those skilled in the art, but this is also included within the scope of the same spirit as the present disclosure.

(13) Hereinafter, the X axis illustrated in the accompanying drawings is the longitudinal direction of the moving object, the Y axis is the width direction, and the Z axis is the thickness direction.

(14) FIG. 1 is a perspective view of a material transferring apparatus for battery manufacturing according to an embodiment.

(15) As illustrated in FIG. 1, the material transferring apparatus for battery manufacturing according to an embodiment may use a method in which a moving unit **120** lifts and moves a support unit **110** in a state in which an object to be moved (not illustrated) is seated in a support region **111a** of the support unit **110**.

(16) The moving unit **120** may be electrically or physically coupled to a separate control unit (not illustrated), and the operation thereof may be controlled by the control unit (not illustrated). An operation in which the moving unit **120** is in contact with the support unit **110**, an operation of moving the support unit **110** by the moving unit **120**, and an operation in which the moving unit **120** is released from contact with the support unit **110** may be controlled by the control unit (not illustrated). In an embodiment, the control unit (not illustrated) may be a programmable logic controller (PLC).

(17) In an embodiment, the moving unit **120** may include at least one mobile robot arm **121** connected to the control unit (not illustrated) and in contact with or released from the support unit **110**. The operation of the mobile robot arm **121** may be controlled by the control unit (not illustrated), and may be in contact with or released from the support unit **110** by the control unit (not illustrated).

(18) The support unit **110** may include the support region **111a** on which an object (not illustrated) is seated. The support unit **110** is in close contact with the object seated in the support region **111a** to fix and protect the object such that the object is not shaken or not damaged during movement.

(19) In an embodiment, the support unit **110** may be provided such that the volume of the support region **111a** may be varied. When the volume of the support region **111a** is provided to be variable, the support unit **110** may be in close contact with the object regardless of the size of the object. Accordingly, objects of various sizes may be easily supported and fixed.

(20) In addition, accordingly, it is possible to prevent meandering or vibrations of the object while the support unit **110** is moved by the moving unit **120**, such that the object may be quickly put into the post-process, thereby contributing to improving the efficiency of the manufacturing process.

(21) In an embodiment, the support unit **110** may include a first contact surface **F1**, and the moving unit **120** may include a second contact surface **F2**. In a state in which the first contact surface **F1** and the second contact surface **F1** are in contact, the moving unit **120** may lift and move the support unit **110**.

(22) A coupling unit **130** may be respectively provided in the support unit **110** and the moving unit **120**, and while the first contact surface **F1** and the second contact surface **F2** maintain mutual contact, the coupling units **130** provided in the support unit **110** and the moving unit **120**, respectively, may be maintained in the state of being in contact with each other. The coupling unit **130** may be provided on one surface the support unit **110** on which the first contact surface **F1** is present, and an area excluding the coupling unit **130** on the one surface of the support unit **110** may be provided as the first contact surface **F1**.

(23) The coupling unit **130** may also be provided on one surface of the moving unit **120** on which the second contact surface **F2** is present, but an area excluding the coupling unit **130** on the one surface of the moving unit **120** may be the second contact surface **F2**.

(24) Before the moving unit **120** is moved in the direction of the support unit **110** and the first contact surface **F1** and the second contact surface **F2** come into contact with each other, the coupling units **130** provided on the support unit **110** and the moving unit **120**, respectively, may contact each other.

(25) Before the support unit **110** and the moving unit **120** contact, the coupling units **130** provided in the support unit **110** and the moving unit **120**, respectively, may contact each other and serve to guide the contact and coupling of the support unit **110** and the moving unit **120**.

(26) The coupling unit **130** may be provided at an optimal position suitable for supporting the load of the object. In an embodiment, the coupling unit **130** may be formed in a position in which at least a partial area of the moving unit **120** may be opposed to the center of the support unit **110** in the Y-axis direction when the first contact surface **F1** and the second contact surface **F2** contact each other. Therefore, the moving unit **120** may move the support unit **110** while preventing the support unit **110** from sagging or meandering in either direction.

(27) The coupling unit **130** respectively provided in the support unit **110** and the moving unit **120** may be provided in contact with each other in the same position as the previous position even when the first contact surface **F1** and the second contact surface **F2** come into contact again after the first contact surface **F1** and the second contact surface **F2** are released from contact. Therefore, once the contact position of the moving unit **120** and the support unit **110** is set, it is not necessary to newly set the contact position of the moving unit **120** and the coupling unit **130** whenever they are re-contacted after the release of the contact between the moving unit **120** and the support unit **110**.

(28) In an embodiment, the coupling unit **130** may be detachably provided to the moving unit **120** and the support unit **110**. The coupling unit **130** may be provided in the form of an insert block to be coupled to or disconnected from the moving unit **120** and the support unit **110**.

(29) In this case, a plurality of grooves (not illustrated) into which the insert block may be inserted are provided in the moving unit **120** and the support unit **110**, and when an insert block is inserted into any one of a plurality of grooves (not illustrated), the position of the coupling unit **130** in the

moving unit **120** and the support unit **110** may be easily adjusted. However, this is not necessarily limited by the present disclosure, and may be appropriately selected and applied according to the working environment.

(30) After the coupling units **130** are in contact with each other, the first contact surface **F1** and the second contact surface **F2** may contact each other. As described above, after the first contact surface **F1** and the second contact surface **F2** contact each other, the moving unit **120** may move the support unit **110**.

(31) By the coupling unit **130**, a contact position between the moving unit **120** and the support unit **110** may be set, and the operation of aligning the support unit **110** on the moving unit **120** may be omitted. According to the coupling unit **130**, a path in which the moving unit **120** and the support unit **110** may be combined with the fastest may be secured, and this path may be used repeatedly.

(32) As such, when the coupling of the moving unit **120** and the supporting unit **110** may be made through the coupling unit **130**, the coupling of the moving unit **120** and the supporting unit **110** may be completed quickly, and since there is no need to newly set the contact position between the moving unit **120** and the support unit **110** whenever an object (not illustrated) is replaced, the efficiency of the battery manufacturing process may be improved, and the convenience of moving materials for manufacturing the battery may be improved.

(33) In an embodiment, the support unit **110** may include a support frame **114** having the support region **111a**, and guide frames **115**, **116** and **117** connected to the support frame **114**, disposed at the periphery of the support region **111a** and contacting an object (not illustrated).

(34) In an embodiment, the guide frames **115**, **116** and **117** may include a plurality of fixed side frames **115** fixed to the support frame **114** and to which the moving unit **120** is in contact, a plurality of guide members **116** connected to the support frame **114** and extending in the Z-axis direction, and a plurality of moving side frames **117** connected to the guide member **116** and the fixed side frame **115** and extending in the X-axis direction.

(35) The plurality of fixed side frames **115** are spaced apart from each other by a predetermined distance in the X-axis direction on the support frame **114** and may oppose each other.

(36) The plurality of guide members **116** extend in the Z-axis direction on the support frame **114**, and may be spaced apart from each other by a predetermined distance in the X-axis and Y-axis directions.

(37) The plurality of moving side frames **117** may be spaced apart from each other by a predetermined distance in the Y-axis direction on the support frame **114** and may oppose each other.

(38) The side surface of the object (not illustrated) seated in the support region **111a** is in contact with the plurality of guide members **116** and the plurality of moving side frames **117**, and the bottom surface of the object (not illustrated) may be in contact with the support frame **114**.

Accordingly, the object (not illustrated) may be prevented from separating from the support unit **110** or meandering in the support unit **110** while the support unit **110** is moved.

(39) The fixed side frame **115** may be fixed on the support frame **114**. In addition, the coupling unit **130** may be provided on one surface on which the fixed side frame **115** faces the mobile robot arm **121**. Accordingly, there is no need to replace the fixed side frame **115** whenever the object (not illustrated) is replaced or the standard of the object (not illustrated) is changed, and thus, the contact position between the mobile robot arm **121** and the fixed side frame **115** may be fixedly set.

(40) In an embodiment, the coupling unit **130** may include a first coupling unit **140** on one surface on which the mobile robot arm **121** faces the fixed side frame **115**, and a second coupling unit **150** provided on one surface on which the fixed side frame **115** faces the mobile robot arm **121**.

(41) The first coupling unit **140** and the second coupling unit **150** are in contact with each other before one surface of the mobile robot arm **121** comes into contact with one surface of the fixed side frame **115**, to guide a contact between one surface of the mobile robot arm **121** and one surface of the fixed side frame **115**.

(42) In addition, the first coupling unit **140** and the second coupling unit **150** are maintained in mutual contact in a state in which one surface of the mobile robot arm **121** and one surface of the fixed side frame **115** are in contact with each other, thereby further increasing the coupling force between the mobile robot arm **121** and the fixed side frame **115**.

(43) Even when the fixed side frame **115** is fixed on the support frame **114** as above, by varying the connection position between the guide member **116** and the moving side frame **117** and the connection position between the moving side frame **117** and the fixed side frame **115**, the volume of the support region **111a** may be changed according to the standard of the object (not illustrated).

(44) In an embodiment, the position for connecting the plurality of guide frames to the support frame **114** on the X-Y plane is changed, and the position of connecting the plurality of moving side frames **117** to the fixed side frame **115** and the guide member **116** on the X-Y plane is changed, and therefore, the circumferential dimension of the support region **111a** may be changed.

(45) FIGS. **2** and **3** are plan views partially illustrating a material transferring apparatus for battery manufacturing according to an embodiment. FIG. **2** is an enlarged view illustrating the state in which a coupling protrusion is being inserted into a coupling groove, and FIG. **3** is an enlarged view of the state in which the insertion of the coupling protrusion into the coupling groove has been completed in the state of FIG. **2**. The material transferring apparatus for battery manufacturing according to an embodiment may have a symmetrical shape in a lateral direction with respect to the center line of FIGS. **2** and **3**.

(46) As illustrated in FIG. **2**, the first coupling unit **140** may include at least one coupling protrusion **141** protruding from the mobile robot arm **121** toward the fixed side frame **115**.

(47) In an embodiment, the coupling protrusions **141** may be provided as a pair, and the pair of coupling protrusions **141** may be spaced apart from each other by a predetermined distance in the Y-axis direction. The center of the fixed side frame **115** in the Y-axis direction may be present in a portion of the fixed side frame **115** opposite to the area between the pair of coupling protrusions **141**.

(48) In an embodiment, the second coupling unit **150** may include a pair of coupling grooves **151** formed in one surface of the fixed side frame **115** opposite to the coupling protrusion **141**. The coupling protrusion **141** may be inserted into the coupling groove **151** in one-to-one correspondence.

(49) According to the coupling protrusion **141** and the coupling groove **151** as described above, the coupling between the mobile robot arm **121** and the fixed side frame **115** may be stably maintained, and while the mobile robot arm **121** lifts and moves the support frame **114**, an object (not illustrated) existing in the support region **111a** may be prevented from sagging or meandering in any one direction. Also, the fixed side frame **115** may be prevented from slipping away from the mobile robot arm **121** while the mobile robot arm **121** lifts and moves the fixed side frame **115**.

(50) In addition, when the center of the fixed side frame **115** in the Y-axis direction exists in a portion of the fixed side frame **115** opposite to the area between the pair of coupling protrusions **141**, the centering operation of the fixed side frame **115** by the mobile robot arm **121** may be completed, only by inserting the coupling protrusion **141** into the coupling groove **151** without an additional device or additional operation to couple the mobile robot arm **121** to the fixed side frame **115**. Accordingly, the convenience of the movement work may be improved and the movement work period of time may be reduced.

(51) On the other hand, the length of the coupling groove **151** in the X-axis direction may be at least the same as the length of the coupling protrusion **141** in the X-axis direction. Before one surface of the mobile robot arm **121** comes into contact with one surface of the fixed side frame **115**, at least a partial region of the coupling protrusion **141** may be in a state of being inserted into the coupling groove **151**.

(52) In an embodiment, the coupling protrusion **141** may include a curved region **142** provided to be rounded, and the coupling groove **151** may include a section inclined at a + slope and a section

inclined at a $-$ slope with respect to the Y axis.

(53) The curved region **142** may serve to reduce the contact resistance when the coupling protrusion **141** is inserted into the coupling groove **151**. In addition, when the coupling groove **151** includes a section inclined at a $+$ slope and a section inclined at a $-$ slope, slide of the curved region **142** of the coupling protrusion **141** in the coupling groove **151** may be facilitated, thereby contributing to allowing the coupling protrusion **141** to be quickly inserted into the coupling groove **151**.

(54) As illustrated in FIG. 3, when the mobile robot arm **121** further moves in the $+X$ direction while the curved region **142** slides in the coupling groove **151**, as the curved region **142** slides in the coupling groove **151**, the contact between one surface of the mobile robot arm **121** and one surface of the fixed side frame **115** may be completed. As such, after the curved region **142** of the coupling protrusion **141** starts to slide in the coupling groove **151**, the operation of aligning the mobile robot arm **121** in the Y-axis direction may be omitted.

(55) The state in which the coupling protrusion **141** is in close contact with the coupling groove **151** and one surface of the mobile robot arm **121** and one surface of the fixed side frame **115** are in contact may be continuously maintained while the mobile robot arm **121** lifts and moves the fixed side frame **115**. Therefore, the fixed side frame **115** may be prevented from being separated from the mobile robot arm **121** while the mobile robot arm **121** lifts and moves the fixed side frame **115**.

(56) As illustrated in FIGS. 2 and 3, the fixed side frame **115** may be fixed to the support frame **114** by a first fastening member **115b**. In an embodiment, the first fastening member **115b** may be a bolt. The fixed side frame **115** may be fixed on the support frame **114** as the bolt passes through the fixed side frame **115** and is fixed to the support frame **114**.

(57) The support frame **114** may include a plurality of first fastening holes **114a** spaced apart from each other by a predetermined distance in the Y-axis direction. A second fastening member **116a** penetrating through the guide member **116** may be coupled to the first fastening hole **114a**. The length of the support region **111a** in the Y-axis direction may be determined depending on the first fastening hole **114a** to which the second fastening member **116a** is coupled.

(58) FIGS. 4 and 5 are front views partially illustrating a material transferring apparatus for battery manufacturing according to another embodiment. FIG. 4 is a front view of a state before the coupling protrusion **141** is inserted into the coupling groove **151**, and FIG. 5 is a front view of a state in which the coupling protrusion **141** has been inserted into the coupling groove **151**. The material transferring apparatus for battery manufacturing may have a symmetrical shape laterally with respect to the center line of FIGS. 4 and 5.

(59) As illustrated in FIG. 4, the mobile robot arm **121** may include a first bent extension portion **123** extending by bending an end **122** in the direction of the fixed side frame **115**. The first bent extension portion **123** may be provided below the coupling protrusion **141** in the $-Z$ direction.

(60) The fixed side frame **115** may include a second bent extension portion **113** extending by bending an end **112** in the direction of the first bent extension portion **123**.

(61) In the state of FIG. 4, the mobile robot arm **121** is further moved in the $+X$ direction, and as illustrated in FIG. 5, when the insertion of the coupling protrusion **141** into the coupling groove **151** is completed, the first bent extension portion **123** and the second bent extension portion **113** may be in contact with each other.

(62) In a state in which the first bent extension portion **123** and the second bent extension portion **113** are in contact with each other, the first bent extension portion **123** may be provided below the second bent extension portion **113** in the $-Z$ direction. Also, the contact state between the first bent extension portion **123** and the second bent extension portion **113** may be maintained while the mobile robot arm **121** moves the support unit (**110** of FIG. 1). Accordingly, while the mobile robot arm **121** lifts the fixed side frame **115** and moves the support unit (**110** in FIG. 1), the second bent extension portion **113** is in further close contact with the first bent extension portion **123** by the weight of the support unit (**110** in FIG. 1). Therefore, the coupling force between the mobile robot

arm **121** and the fixed side frame **115** may further increase, and the mobile robot arm **121** may more easily support the load of the support unit (**110** of FIG. 1) and the object (not illustrated) seated in the support region **111a**. Also, the coupling protrusion **141** may be prevented from being separated from the coupling groove **151**.

(63) In an embodiment, the coupling protrusion **141** and the fixed side frame **115** may be formed of a material including magnetic properties. Accordingly, the coupling protrusion **141** may be more easily inserted into the coupling groove **151** by magnetic force, and even when the coupling protrusion **141** is outside the coupling groove **151**, the coupling protrusion **141** may be easily guided to the coupling groove **151**. In addition, it may be easier to maintain the state in which the coupling protrusion **141** is inserted into the coupling groove **151**.

(64) In an embodiment, a magnetic body (not illustrated) may be embedded in the coupling protrusion **141** and the fixed side frame **115**.

(65) In an embodiment, the fixed side frames **115** may be provided as a pair, and a pair of fixed side frames **115** may be disposed to be spaced apart from each other in the X-axis direction. A pair of fixed side frames **115** may surround a portion of the support region **111a**.

(66) A pair of mobile robot arms **121** may also be provided to correspond to a pair of fixed side frames **115**. A pair of mobile robot arms **121** may also be spaced apart by a first length in the X-axis direction, and the pair of mobile robot arms **121** may contact the fixed side frame **115**, while being spaced apart by the first length.

(67) The first length may be a value corresponding to a separation distance in a direction parallel to the X-axis, from the end **122** of one mobile robot arm **121** to the end **122** of another mobile robot arm (**121** in FIG. 1).

(68) The pair of mobile robot arms **121** may contact the pair of fixed side frames **115** while maintaining a state of being spaced apart by the first length.

(69) In an embodiment, in the pair of fixed side frames **115**, surfaces with which the pair of mobile robot arms **121** are in contact may be spaced apart from each other by a first length in the X-axis direction. Accordingly, the alignment operation between the mobile robot arm **121** and the fixed side frame **115** may be omitted. In addition, the mobile robot arm **121** may be brought into close contact with the fixed side frame **115** regardless of whether the length of the object (M in FIG. 6) existing in the support region **111a** is changed. Accordingly, even in a case in which the length of the object (M in FIG. 6) is changed, there is no need to perform a separate alignment operation between the mobile robot arm **121** and the fixed side frame **115**, thereby contributing to improving battery productivity.

(70) FIG. 6 is a perspective view of the support unit **110** according to an embodiment.

(71) As illustrated in FIG. 6, the object may be seated on an upper portion of the support frame **114** in the +Z direction. The object may be provided as a plurality of objects, and the plurality of objects may be stacked in the +Z direction. In an embodiment, the object may be an electrode plate on which the notching operation has been completed.

(72) The guide member **116** may be in close contact with each vertex P of the stacked object and the area around the vertex P. The guide member **116** may extend in the stacking direction of the objects to be in close contact with all of the plurality of objects present on the support frame **114**. According to the guide member **116**, the stacked object may be prevented from shaking in the support frame **114** or from being separated from the support frame **114**.

(73) The moving side frame **117** may be supported on the guide member **116** to face the side of the object. This moving side frame **117** may protect the side of the object and may prevent the object from being separated in the Y-axis direction.

(74) FIG. 7 is an exploded perspective view of the support unit **110** according to an embodiment.

(75) As illustrated in FIG. 7, the support frame **114** may include a plurality of first fastening holes **114a** disposed to be spaced apart from each other in the longitudinal and width directions of the object (M in FIG. 6), and a plurality of second fastening holes **114b** disposed to be spaced apart

from each other in the width direction of the object (M in FIG. 6). The guide member **116** may be opposed to the first fastening holes **114a**, and the fixed side frame **115** may be opposed to the second fastening holes **114b**.

(76) A pair of fixed side frames **115** are spaced apart from each other by a predetermined distance in the X-axis direction on the support frame **114**, and may be disposed to oppose each other. A plurality of third fastening holes **115c** may be provided in the plurality of fixed side frames **115**. The plurality of third fastening holes **115c** may be disposed to be spaced apart from each other in the width direction of the object (M in FIG. 6), and the plurality of third fastening holes **115c** may face the plurality of second fastening holes **114b** formed in the support frame **114**.

(77) A fastening member (not illustrated) may be inserted into the second fastening hole **114b** and the third fastening hole **115c** to fix the fixed side frame **115** to the support frame **114**. The second fastening hole **114b** and the third fastening hole **115c** are provided as a plurality of holes, and when a fastening member (not illustrated) is inserted in each of the second fastening holes **114b** and the third fastening holes **115c**, the fixed side frame **115** may be more firmly fixed to the support frame **114**.

(78) The fixed side frame **115** may include a plurality of first gap adjustment holes **115a**. The first gap adjustment hole **115a** may have a slit shape as a through hole formed in the Y-axis direction. A first fixing member **118a** may be inserted into the first gap adjustment hole **115a**. An end **118ab** of the first fixing member **118a** may contact one surface of the guide member **116**.

(79) In the guide member **116**, four guide members **116** may be provided on one support frame **114**, and each of the guide members **116** may include a fourth fastening hole **116c**. The fourth fastening hole **116c** may face the first fastening hole **114a** formed in the support frame **114** in a one-to-one manner. The guide member **116** may be fixed to the support frame **114** by inserting a fastening member (not illustrated) into the first fastening hole **114a** and the fourth fastening hole **116c**.

(80) Since the plurality of first fastening holes **114a** are disposed to be spaced apart from each other in the longitudinal direction and the width direction of the object (M in FIG. 6), the fourth fastening hole **116c** may be opposed to the first fastening hole **114a** provided in a position corresponding to the length and width of the object (M in FIG. 6). When a fastening member (not illustrated) is inserted into the first fastening hole **114a** and the fourth fastening hole **116c**, the guide member **116** may be fixed to the support frame **114**. Accordingly, the guide member **116** may be fixed at a position in which the guide member **116** may be brought into close contact with the vertex (P in FIG. 6) of the object (M in FIG. 6).

(81) For example, when the length and width of the object (M in FIG. 6) are changed, by changing the first fastening hole **114a** opposite to the fourth fastening hole **116c**, the guide member **116** may be brought into close contact with the object (M in FIG. 6).

(82) In an embodiment, the fastening member (not illustrated) may include a first fastening member **115b** inserted into the second fastening hole **114b** of the support frame **114** and the third fastening hole **115c** of the fixed side frame **115**, and a second fastening member **116a** inserted into the first fastening hole **114a** of the support frame **114** and the fourth fastening hole **116c** of the guide member **116**. In an embodiment, the first fastening member **115b** and the second fastening member **116a** may be bolts.

(83) According to the above configuration, the separation distance between the pair of guide members **116** in the width direction (Y-axis direction) and the longitudinal direction (X-axis direction) of the object (M in FIG. 6) may be adjusted, and even when the length and width of the object (M in FIG. 6) is changed, the guide member **116** may be brought into close contact with the vertex (P in FIG. 6) of the object (M in FIG. 6).

(84) On the other hand, the moving side frame **117** may be provided as a pair, and the pair of moving side frames **117** may be coupled to concave portions **116b** of the guide member **116** to be spaced apart from each other in the Y-axis direction on the support frame **114**. The moving side frame **117** may be provided with a plurality of second gap adjustment holes **117a**, and the second

gap adjustment hole **117a** may be provided in the form of a slit as a through hole. A second fixing member **118b** is inserted into the second gap adjustment hole **117a** such that an end **118ba** of the second fixing member **118b** may be in contact with one surface of the guide member **116**. In an embodiment, the second fixing member **118b** may be a bolt. Accordingly, even when the guide member **116** is moved in the X-axis direction, the moving side frame **117** and the guide member **116** may be easily combined.

(85) In an embodiment, the support frame **114** may be formed by stacking a plurality of support frames in the Z-axis direction. The plurality of support frames **114** may be welded to each other or bolted to each other. In an embodiment, the support frame **114** present at the upper part in the +Z direction may be provided as a pair, and a distance between the pair of support frames **114** in the Y-axis direction may be shorter than a length of the support frame **114** provided therebelow in the Y-axis direction.

(86) Accordingly, the support frame **114** may have a stepped portion **114c**. When the gap between the pair of guide members **116** in the Y-axis direction is relatively narrowed, the stepped portion **114c** may be in close contact with one surface of the guide member **116** present on the X-Z plane. Accordingly, the guide member **116** may be prevented from being pushed out in the outer circumferential direction of the support frame **114**, and the guide member **116** may be supported more firmly.

(87) FIG. **8** is a perspective view of the support unit **110** according to another embodiment.

(88) As illustrated in FIG. **8**, the plurality of guide members **116** may be moved in the X-axis direction and the Y-axis direction with respect to the fixed side frame **115** and the moving side frame **117**, to be fixed to the support frame **114**. Accordingly, a support region **111b** deformed inwardly of the plurality of guide members **116** may be formed. The deformed support region **111b** may have a narrower area than that of the support region (see **111a** of FIG. **1**) formed in FIG. **1**, which may be suitable for supporting an object (not illustrated) of which the area is narrower than that of the object (not illustrated) to be seated in the support region of FIG. **1** (**111a** in FIG. **1**).

(89) In this manner, by moving the guide member **116**, the area of the support regions **111a** and **111b** may be appropriately deformed to fit the area of the object (M in FIG. **6**). Accordingly, there is no need to replace the support unit **110** whenever the area of the object (M in FIG. **6**) changes, and maintenance costs of the apparatus may be reduced, and manufacturing costs may also be reduced.

(90) As set forth above, according to an embodiment of the present disclosure, battery manufacturing efficiency may be improved.

(91) In addition, according to an embodiment, the battery manufacturing process may be automated, and the convenience of battery manufacturing operations may be improved.

(92) While example embodiments have been illustrated and described above, it will be apparent to those skilled in the art that modifications and variations could be made without departing from the scope of the present disclosure as defined by the appended claims.

Claims

1. A material transferring apparatus for battery manufacturing, comprising: a support unit having a support region for supporting an object and having a first contact surface; a moving unit having a second contact surface in contact with the support unit and moving the support unit; and coupling units provided on the support unit and the moving unit, respectively, and contacting each other before the first contact surface and the second contact surface come into contact with each other, wherein the support unit includes, a support frame having the support region; and a guide frame connected to the support frame and disposed at the periphery of the support region to contact the object, wherein the guide frame is provided to vary an area of the support region, wherein the guide frame includes, a fixed side frame fixed to the support frame and contacting the moving unit; a

guide member connected to the support frame and extending in a thickness direction of the object to contact a side surface of the object; and a moving side frame connected to the guide member and the fixed side frame and extending in a longitudinal direction or a width direction of the object, wherein the moving side frame is provided such that a position connected to the fixed side frame and the guide member is varied to vary the area of the support region, wherein the support frame includes, a plurality of first fastening holes spaced apart from each other in the longitudinal direction and the width direction of the object; and a plurality of second fastening holes spaced apart from each other in the width direction of the object, wherein the fixed side frame includes a plurality of third fastening holes facing the plurality of second fastening holes, the guide member includes a fourth fastening hole opposite to the plurality of first fastening holes, and the plurality of first fastening holes, the plurality of second fastening holes, the plurality of third fastening holes and the fourth fastening hole are provided with a fastening member inserted thereinto.

2. The material transferring apparatus of claim 1, wherein the coupling units are maintained in a state of being in contact with each other while the first contact surface and the second contact surface are in contact with each other.

3. The material transferring apparatus of claim 1, wherein the coupling units includes, a first coupling unit provided in a region facing the fixed side frame in the moving unit; and a second coupling unit provided in a region facing the moving unit in the fixed side frame, wherein the first coupling unit and the second coupling unit are provided to be in contact with each other before the moving unit and the fixed side frame come into contact, and are maintained in a state of being in contact with each other while the moving unit contacts the fixed side frame.

4. The material transferring apparatus of claim 3, wherein the first coupling unit includes at least one coupling protrusion protruding from the moving unit toward the fixed side frame, and the second coupling unit includes at least one coupling groove, which is disposed in the fixed side frame and into which the coupling protrusion is inserted.

5. The material transferring apparatus of claim 4, wherein the coupling protrusion and the fixed side frame include a magnetic material.

6. The material transferring apparatus of claim 4, wherein the coupling protrusion includes a curved region sliding in the coupling groove.

7. The material transferring apparatus of claim 6, wherein the coupling groove includes a section inclined with respect to the longitudinal direction of the object.

8. A material transferring apparatus for battery manufacturing, comprising: a support unit having a support region for supporting an object and having a first contact surface; a moving unit having a second contact surface in contact with the support unit and moving the support unit; and coupling units provided on the support unit and the moving unit, respectively, and contacting each other before the first contact surface and the second contact surface come into contact with each other, wherein the support unit includes, a support frame having the support region; and a guide frame connected to the support frame and disposed at the periphery of the support region to contact the object, wherein the guide frame is provided to vary an area of the support region, wherein the guide frame includes, a fixed side frame fixed to the support frame and contacting the moving unit; a guide member connected to the support frame and extending in a thickness direction of the object to contact a side surface of the object; and a moving side frame connected to the guide member and the fixed side frame and extending in a longitudinal direction or a width direction of the object, wherein the moving side frame is provided such that a position connected to the fixed side frame and the guide member is varied to vary the area of the support region, wherein the moving unit includes at least one mobile robot arm in contact with the fixed side frame, wherein the at least one mobile robot arm includes a first bent extension portion provided by bending and extending an end thereof in a direction of the fixed side frame, the fixed side frame includes a second bent extension portion provided by bending and extending an end thereof in a direction of the at least one mobile robot arm and contacting the first bent extension portion, and the first bent extension portion is

present below the second bending extension portion in a direction of gravity, while the at least one mobile robot arm moves the support unit.

9. A material transferring apparatus for battery manufacturing, comprising: a support unit having a support region for supporting an object and having a first contact surface; a moving unit having a second contact surface in contact with the support unit and moving the support unit; and coupling units provided on the support unit and the moving unit, respectively, and contacting each other before the first contact surface and the second contact surface come into contact with each other, wherein the support unit includes, a support frame having the support region; and a guide frame connected to the support frame and disposed at the periphery of the support region to contact the object, wherein the guide frame is provided to vary an area of the support region, wherein the guide frame includes, a fixed side frame fixed to the support frame and contacting the moving unit; a guide member connected to the support frame and extending in a thickness direction of the object to contact a side surface of the object; and a moving side frame connected to the guide member and the fixed side frame and extending in a longitudinal direction or a width direction of the object, wherein the moving side frame is provided such that a position connected to the fixed side frame and the guide member is varied to vary the area of the support region, wherein a plurality of the fixed side frames are disposed to face each other in the support frame and include one or more first gap adjustment holes, a plurality of the moving side frames are disposed to face each other in the support frame and include one or more second gap adjustment holes, and a plurality of the guide members are disposed to face the first gap adjustment hole and the second gap adjustment hole, and wherein the support unit further comprises, one or more first fixing members inserted into the one or more first gap adjustment holes, ends of the one or more first fixing members being in contact with the guide member; and a plurality of second fixing members inserted into the one or more second gap adjustment holes, ends of the plurality of second fixing member being in contact with the guide member.

10. The material transferring apparatus of claim 1, wherein the fastening member includes, a first fastening member inserted into the plurality of second fastening holes and the plurality of third fastening holes to fix the fixed side frame to the support frame; and a second fastening member inserted into the plurality of first fastening holes and the fourth fastening hole to fix the guide member to the support frame.

11. The material transferring apparatus of claim 8, wherein a plurality of the fixed side frames are spaced apart from each other in the longitudinal direction or the width direction of the object, a plurality of the mobile robot arms are in contact with the plurality of fixed side frames in a state in which ends thereof are spaced apart from each other by a first length, and a plurality of the fixed side frames are fixed to the support frame in such a manner that surfaces in contact with the plurality of mobile robot arms are spaced apart by the first length.
