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(54) **TAPE ATTACHMENT DEVICE AND TAPE ATTACHMENT METHOD**

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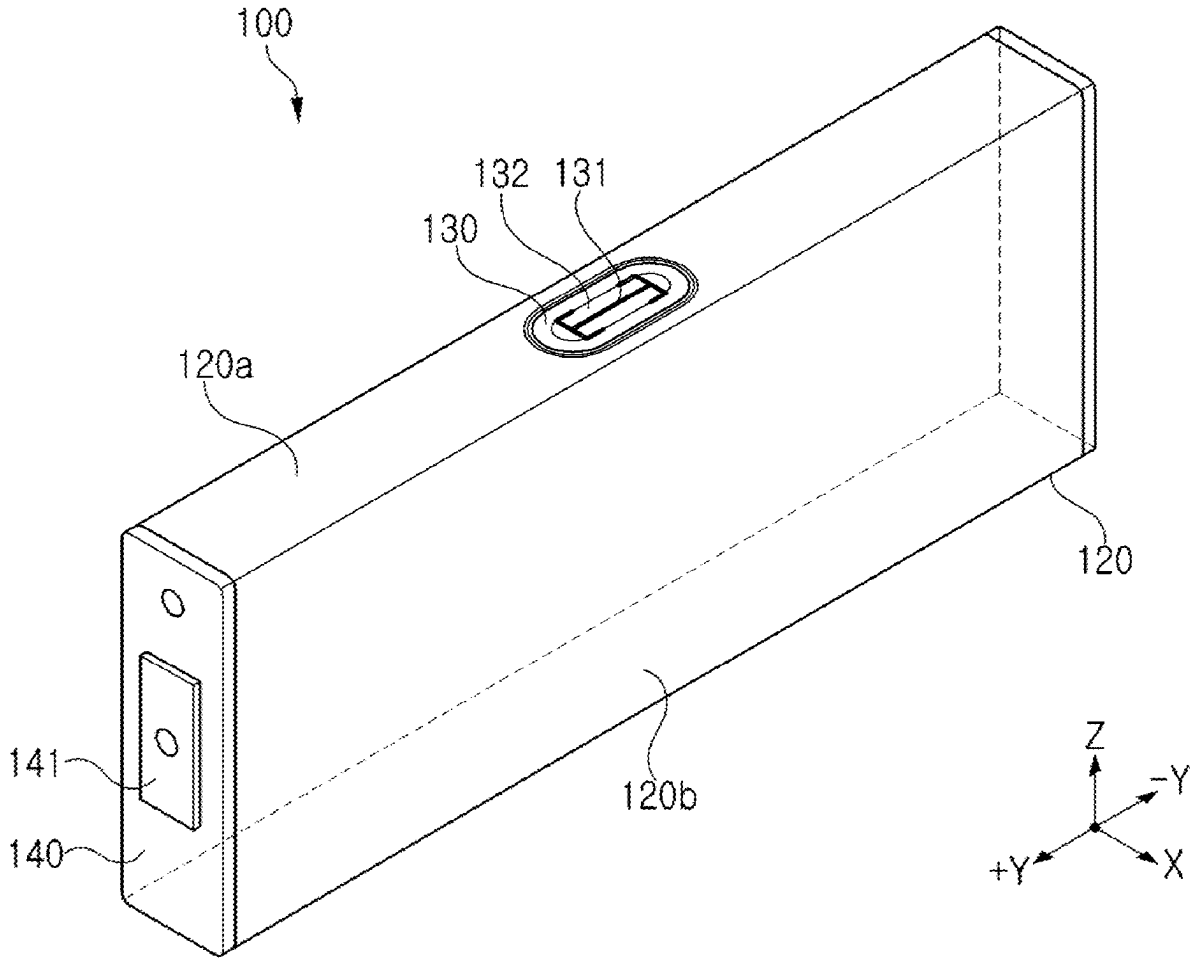
(57) **ABSTRACT**

A tape attachment device of the present disclosure includes a roller shaft including a first end portion and a second end portion opposite to the first end portion, and a pressing member including a first cylinder connected to the first end portion, and a second cylinder connected to the second end portion and configured to operate independently of the first cylinder. The roller shaft may be configured to tilt based on movement of the pressing member.



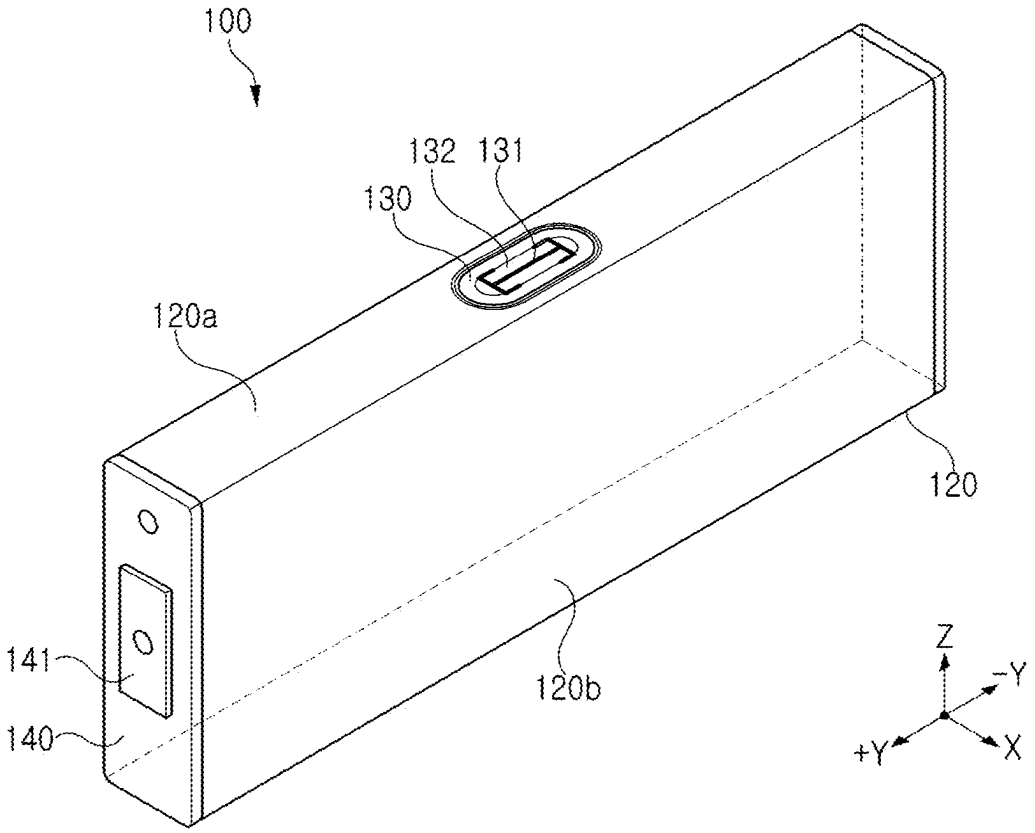


FIG. 1

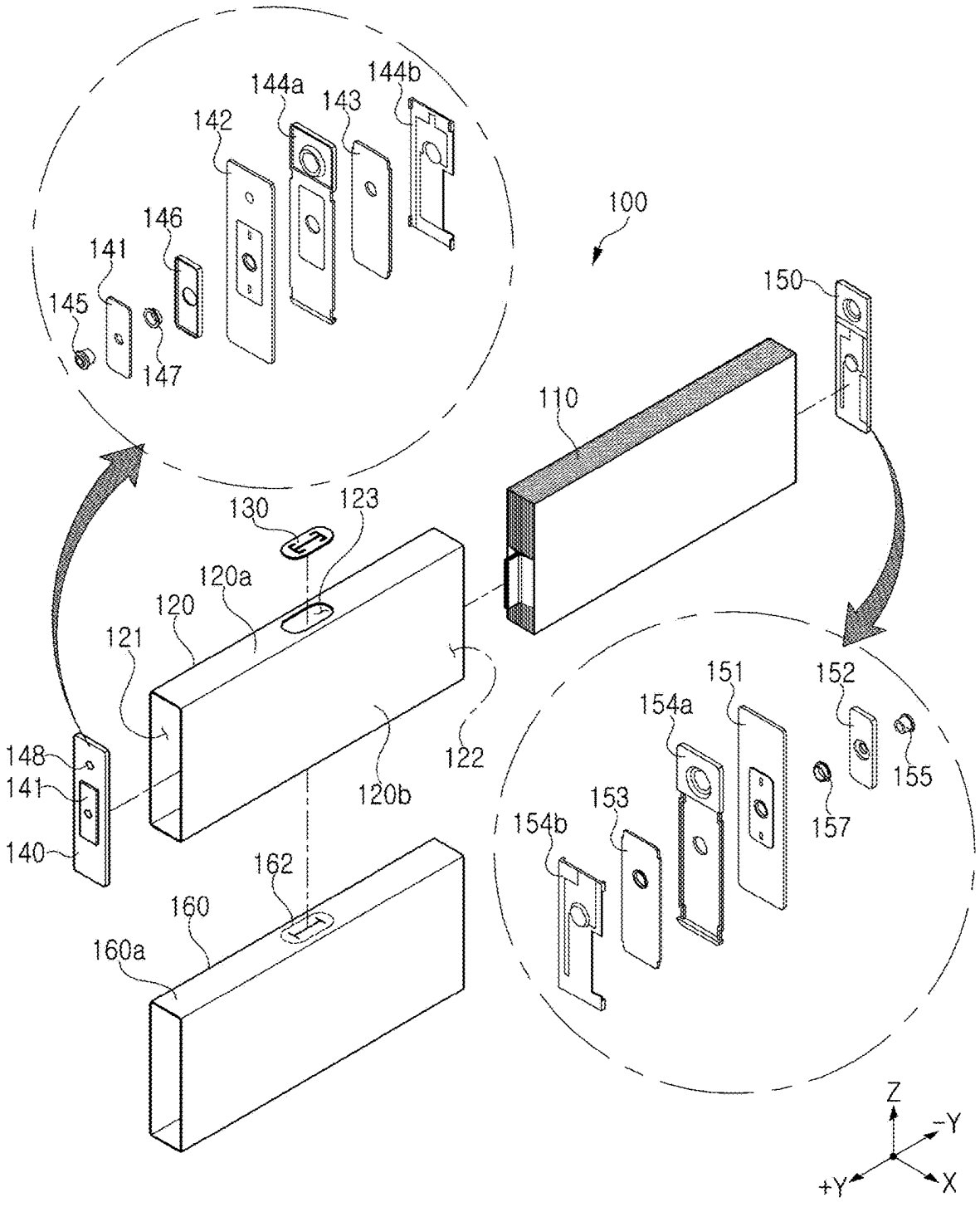

100
110
120
120a
120b
121
122
123
130
140
141
142
143
144a
144b
145
146
147
148
150
151
152
153
154a
154b
155
157
160
160a
162
Z
-Y
+Y
X

FIG. 2

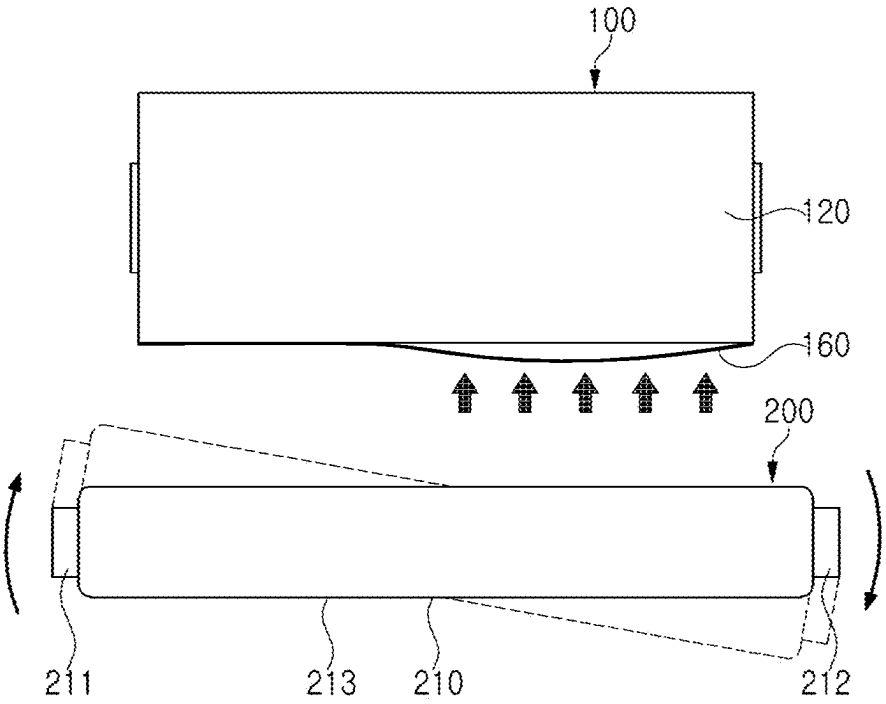


FIG. 3

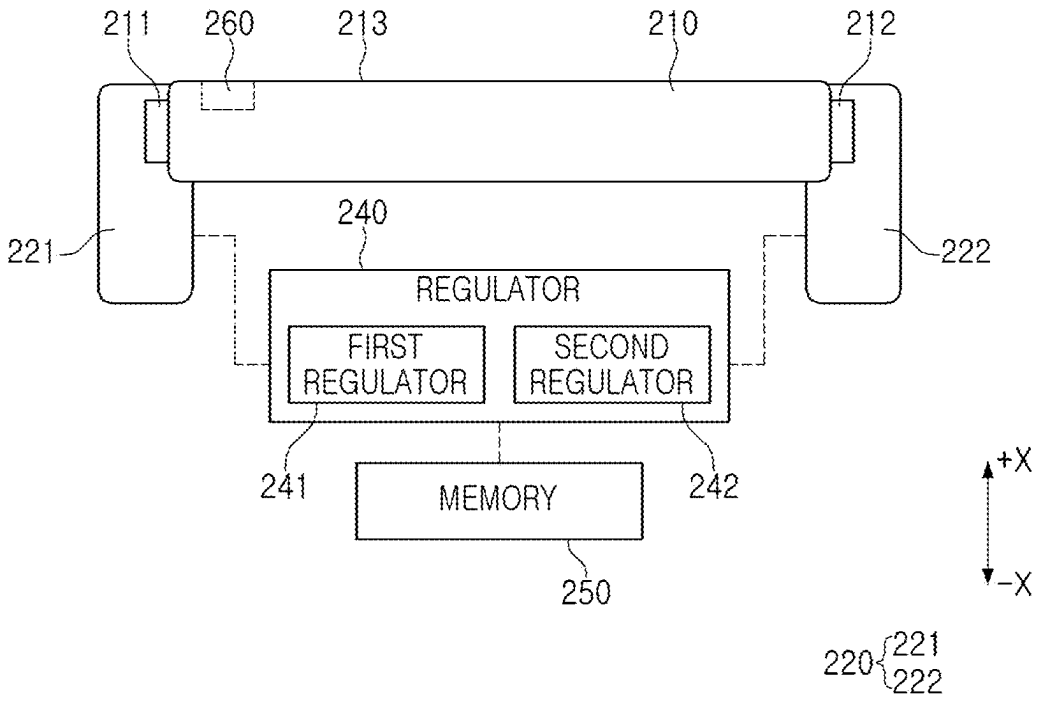

211
260
213
210
212
240
221
222
REGULATOR
FIRST REGULATOR
SECOND REGULATOR
241
242
MEMORY
250
+X
-X
220
221
222

FIG. 4A

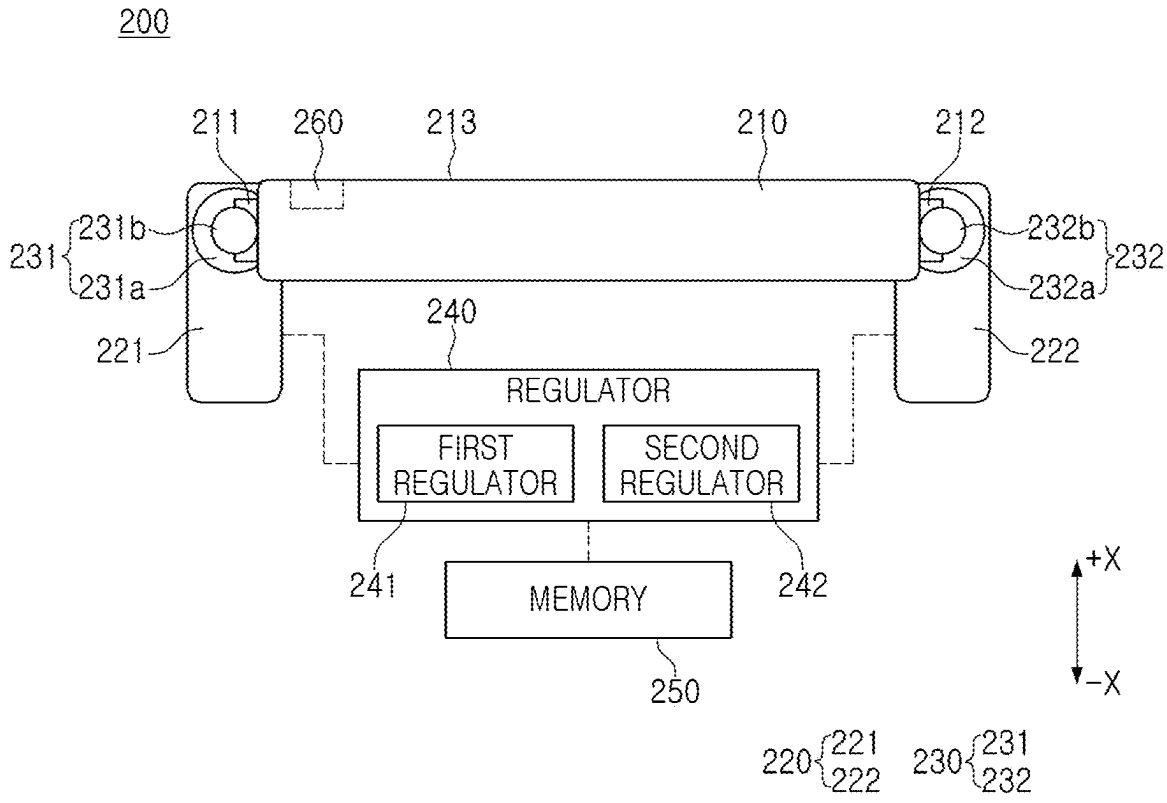

200
211
260
213
210
212
231
231b
231a
232
232b
232a
240
221
222
REGULATOR
FIRST REGULATOR
SECOND REGULATOR
241
242
MEMORY
250
+X
-X
220
221
222
230
231
232

FIG. 4B

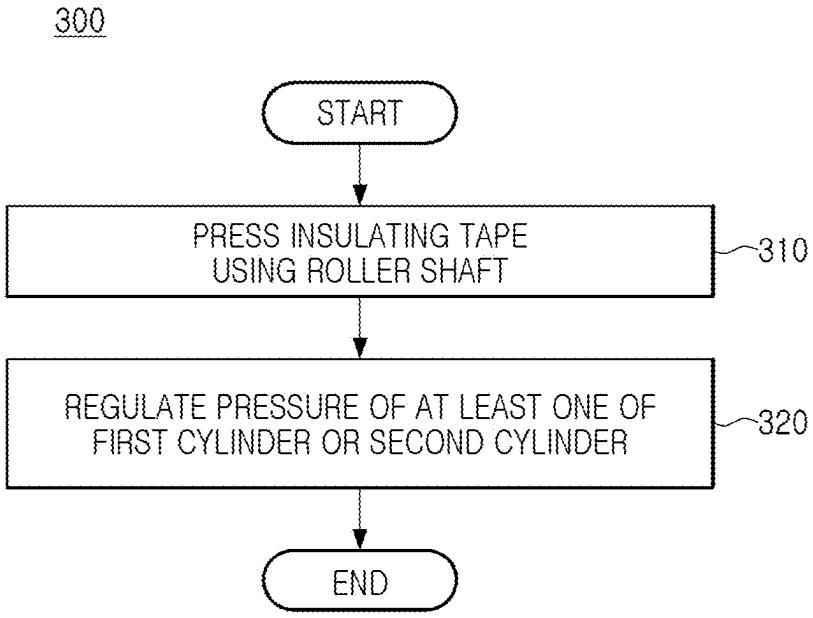

300
START
PRESS INSULATING TAPE USING ROLLER SHAFT
310
REGULATE PRESSURE OF AT LEAST ONE OF FIRST CYLINDER OR SECOND CYLINDER
320
END

FIG. 5

TAPE ATTACHMENT DEVICE AND TAPE ATTACHMENT METHOD

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This patent document claims the priority and benefits of Korean Patent Application No. 10-2024-0023311 filed on Feb. 19, 2024, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The disclosure and implementations disclosed in this patent document generally relate to a tape attachment device and a tape attachment method.

BACKGROUND

[0003] Unlike a primary battery, a secondary battery may be charged and discharged, and may thus be applied to devices within various fields such as a digital camera, a mobile phone, a laptop, a hybrid vehicle, an electric vehicle, and an energy storage system (ESS). The secondary battery may be a lithium-ion battery, a nickel-cadmium battery, a nickel-metal hydride battery, or a nickel-hydrogen battery.

[0004] The secondary battery may be manufactured as a flexible pouch-type battery cell or a rigid square or cylindrical can-type battery cell. A plurality of battery cells may be formed as a cell assembly in a stacked form.

[0005] The cell assembly may be disposed in a case to form a battery module, and a plurality of battery modules may be disposed in a pack frame to form a battery pack. The battery pack may be used in various structures such as a vehicle or an energy storage system.

SUMMARY

[0006] A tape may be attached to an object (e.g., battery cell or a cell assembly) using a roller pressing the tape. When the tape is attached to an object having a curved shape, the tape may not be in close contact with the object, thereby reducing adhesive strength of the tape. For example, when the tape is attached to a case of a square battery cell in which a curve is formed, or when the tape is attached to a curved sealing portion of a pouch-type battery cell, a contact area between the tape and the case may be reduced due to the curve, thereby reducing the adhesive strength of the tape, and air bubbles may be generated between the tape and the case.

[0007] According to an aspect of the present disclosure, a tape attachment device and a tape attachment method, increasing a contact area between a tape and an object to improve adhesive strength of the tape and reduce air bubbles, may be provided. A battery cell manufactured by a tape attachment device of the present disclosure may be widely applied in green technology fields such as to an electric vehicle, a battery charging station, and solar and wind power generation using batteries. In addition, the battery cell manufactured by the tape attachment device of the present disclosure may be used in an eco-friendly electric vehicle, a hybrid vehicle, or the like to prevent a change in climate by suppressing air pollution and greenhouse gas emissions.

[0008] In some embodiments of the present disclosure, a tape attachment device of the present disclosure includes a roller shaft including a first end portion and a second end portion opposite to the first end portion, and a pressing member including a first cylinder connected to the first end portion, and a second cylinder connected to the second end portion and configured to operate independently of the first cylinder. The roller shaft may be configured to tilt based on movement of the pressing member.

[0009] According to an embodiment, the tape attachment device may include a first guide member rotatably connecting the first end portion to the first cylinder, and a second guide member rotatably connecting the second end portion to the second cylinder.

[0010] According to an embodiment, the first guide member may include a first bearing support coupled to the first cylinder, and a first bearing connected to the first end portion and rotatably coupled to the first bearing support. The second guide member may include a second bearing support coupled to the second cylinder, and a second bearing connected to the second end portion and rotatably coupled to the second bearing support.

[0011] In an embodiment, the tape attachment device may further include a memory configured to store external surface curvature data of the battery cell, and a regulator configured to regulate pressure of at least one of the first cylinder or the second cylinder, based on the external surface curvature data.

[0012] In an embodiment, the regulator may include a first regulator configured to regulate first pressure of the first cylinder, and a second regulator configured to regulate second pressure of the second cylinder.

[0013] In an embodiment, a first stroke distance of the first cylinder may be configured to be changed based on the first pressure, and a second stroke distance of the second cylinder may be configured to be changed based on the second pressure. A slope of the roller shaft may be configured to be changed based on the first stroke distance and the second stroke distance.

[0014] In an embodiment, the roller shaft may be configured to provide external force to a tape, and may include an external circumferential surface located between the first end portion and the second end portion.

[0015] In an embodiment, the first cylinder and the second cylinder may each include at least one of a pneumatic cylinder, a hydraulic cylinder, or an actuator, respectively.

[0016] In an embodiment, the second cylinder may be disposed parallel to the first cylinder.

[0017] In an embodiment, the tape attachment device may further include a memory configured to store a limit pressure value, and a pressure sensor disposed on the roller shaft. Output of the pressing member may be configured to be changed based on a pressure value sensed by the pressure sensor and the limit pressure value.

[0018] In some embodiments of the present disclosure, a tape attachment method of the present disclosure may include a pressing operation of pressing a tape using a roller shaft, and a pressure regulating operation of regulating at least one of pressure of a first cylinder connected to a first end portion of the roller shaft, or pressure of a second cylinder connected to a second end portion of the roller shaft. The roller shaft may be configured to tilt based on the pressure regulating operation.

BRIEF DESCRIPTION OF DRAWINGS

[0019] Certain aspects, features, and advantages of the present disclosure may be illustrated by the following detailed description with reference to the accompanying drawings.

[0020] FIG. **1** is a perspective view of a battery cell according to an embodiment.

[0021] FIG. **2** is an exploded perspective view of a battery cell according to an embodiment.

[0022] FIG. **3** is a schematic diagram illustrating an operation of a tape attachment device according to an embodiment.

[0023] FIGS. **4**A and **4**B are schematic diagrams of a tape attachment device according to an embodiment.

[0024] FIG. **5** is a flow chart of a tape attachment method according to an embodiment.

DETAILED DESCRIPTION

[0025] Hereinafter, the disclosure of this patent document will be described in detail with reference to the attached drawings. However, this is merely illustrative and the disclosure of this patent document is not limited to the specific embodiments described by way of example.

[0026] Terms or words used in the specification and claims described below may not be to be construed as limited to their ordinary or dictionary meanings. The inventor will interpret the meaning and concept consistent with the technical idea of the disclosure of this patent document based on the principle that the concept of the term is appropriately defined in order to explain the disclosure of this patent document in the best manner.

[0027] Accordingly, the embodiments described in this specification and the configurations illustrated in the drawings may be only the most preferred embodiments of the disclosure of this patent document, and do not represent the entire technical idea of the disclosure of this patent document, and it will be appreciated that there are various equivalents and variations may be substituted therefor at the time of filing the disclosure of this patent document.

[0028] Detailed descriptions of well-known functions and configurations that may obscure the gist of the disclosure of this patent document may be omitted. In the attached drawings, some components may be exaggerated, omitted, or schematically illustrated, and a size of each of the components does not entirely reflect an actual size thereof.

[0029] FIG. **1** is a perspective view of a battery cell according to an embodiment. FIG. **2** is an exploded perspective view of a battery cell according to an embodiment.

[0030] Referring to FIG. **1** and/or FIG. **2**, a battery cell **100** may include an electrode assembly **110**, a case **120**, a venting portion **130**, a cap assembly (**140** and **150**), and/or a tape **160**. The battery cell **100** may be a secondary battery. For example, the battery cell **100** may be a lithium ion battery, but is not limited thereto. For example, the battery cell **100** may be a nickel-cadmium battery, a nickel-metal hydride battery, or a nickel-hydrogen battery, capable of being charged and discharged.

[0031] The electrode assembly **110** may include at least one positive electrode plate, at least one negative electrode plate, and at least one separator. Those skilled in the art will appreciate that the electrode assembly **110** may be manufactured using variety of methods. In example embodiments, the electrode assembly may be formed by repeatedly arranging the positive electrode, the negative electrode, and the separator. In some embodiments, the electrode assembly may be a winding type, a stacking type, a Z-folding type, or a stack-folding type.

[0032] The case **120** may form at least a portion of an exterior of the battery cell **100**, and may accommodate the electrode assembly **110**. For example, the case **120** may provide a space in which the electrode assembly **110** and an electrolyte are accommodated. In an embodiment, the case **120** may include aluminum. The case **120** may be referred to as a can or a housing. The case **120** may have a rectangular parallelepiped shape in which at least a portion thereof opens. For example, the case **120** may include a first side surface **120***a* and a second side surface **120***b* having a width, greater than a width of the first side surface **120***a*. The first side surface **120***a* may be referred to as a narrow surface, and the second side surface **120***b* may be referred to as a wide surface.

[0033] According to an embodiment, the case **120** may include a first opening **121** formed at one side (+Y-direction) of a length direction (Y-axis direction) of the battery cell **100**, a second opening **122** formed on the other side (−Y-direction) of the length direction, and a through-hole **123** formed in a height direction (Z-axis direction) of the battery cell **100**. The first opening **121**, the second opening **122**, and the through-hole **123** may be an empty space connected in an internal space of the case **120**.

[0034] The cap assembly (**140** and **150**) may be respectively coupled to both sides in the length direction (e.g., Y-axis direction) of the case **120**. For example, the cap assembly (**140** and **150**) may accommodate the electrode assembly **110** and the electrolyte, together with the case **120**. The cap assembly (**140** and **150**) may include a first cap assembly **140** coupled to an end portion of the case **120** in the second direction (+Y direction), and a second cap assembly **150** coupled to an end portion of the case **120** in the third direction (−Y direction) opposite to the second direction (+Y direction). The first cap assembly **140** may seal the first opening **121** of the case **120**. The second cap assembly **150** may seal the second opening **122** of the case **120**.

[0035] The cap assembly (**140** and **150**) may include a plurality of components.

[0036] In an embodiment, the cap assembly (**140** and **150**) may include a cap plate (**142** and **151**) coupled to the case **120** to seal the case **120**. For example, the cap plate (**142** and **151**) may be formed of aluminum or a material including aluminum. The cap plate (**142** and **151**) may be laser welded to the case **120** along an edge portion. When the cap plate (**142** and **151**) is coupled to the case **120**, since an internal space of the case **120** may be sealed, at least one of the cap plates **142** and **151** may include an electrolyte injection port **148** for injecting an electrolyte into the internal space of the case **120**. The electrolyte injection port **148** may be sealed with a stopper or the like after the electrolyte is injected.

[0037] The cap assembly (**140** and **150**) may include a terminal plate (**141** and **152**). The terminal plate (**141** and **152**) may be coupled to one surface of the cap plate (**142** and **151**). The one surface of the cap plate (**142** and **151**) may be a surface, opposite to a surface facing the internal space of the case **120**. When the battery cell **100** is configured to form a module or a pack, the battery cell **100** may be electrically connected to a battery cell **100** disposed adjacently thereto, through the terminal plate (**141** and **152**).

[0038] The terminal plate (**141** and **152**) may have positive polarity or negative polarity. For example, based on the drawings, a first terminal plate **141** disposed in the second direction (+Y direction) of the case **120** may have negative polarity, and a second terminal plate **152** disposed in the third direction (−Y direction) of the case **120** may have positive polarity. For example, the terminal plates **141** and **152** may be electrically connected to the electrode assembly **110** through electrode tabs, respectively.

[0039] In an embodiment, an insulating plate (outer insulating plate) **146** may be disposed between a terminal plate having negative polarity (e.g., first terminal plate **141**) and a first cap plate **142**.

[0040] A current collector plate (**143** and **153**) may be disposed on the other surface of the cap plate (**142** and **151**). The current collector plate (**143** and **153**) may be connected to an electrode tab portion of a first electrode plate **111** or an electrode tab portion of a second electrode plate **112** in the electrode assembly **110**, respectively, to have positive polarity or negative polarity. An insulating plate (inner insulating plate) (**144***a*, **144***b*, **154***a*, and **154***b*) may be disposed between the cap plate (**142** and **151**) and the current collector plate (**143** and **153**) and between the current collector plate (**143** and **153**) and the internal space of the case **120**, respectively.

[0041] According to an embodiment of the present disclosure, the cap assembly (**140** and **150**) may include a rivet terminal (**145** and **155**) passing in a thickness direction from the terminal plate (**141** and **152**) and extending to the current collector plate (**143** and **153**). To this end, the cap plate (**142** and **151**), the terminal plate (**141** and **152**), the current collector plate (**143** and **153**), and a portion of the insulating plates (**144***a* and **154***a*) may include a hole into which the rivet terminal (**145** and **155**) is inserted, and a gasket (**147** and **157**) may be fitted between the hole and the rivet terminal (**145** and **155**).

[0042] Components of the cap assembly (**140** and **150**), described above, are only illustrative, so some of the components of the cap assembly (**140** and **150**) may be omitted or other configurations not described may be added.

[0043] The venting portion **130** may provide a path releasing gas generated from the internal space of the case **120** to an external space of the case **120**. For example, the venting portion **130** may include a notch portion **131** configured to be ruptured at a specified pressure or higher, and a base **132** coupled to the case **120**.

[0044] According to an embodiment, the venting portion **130** may be located on the first side surface **120***a* of the case **120** in which a relatively large stress value appears, among remaining surfaces of the case **120** excluding a portion to which the cap assembly (**140** and **150**) is coupled. The venting portion **130** may be located between the first cap assembly **140** and the second cap assembly **150**. According to an embodiment, at least a portion of the venting portion **130** may be disposed in the through-hole **123** formed in the first side surface **120***a*.

[0045] In a battery cell **100** including a plurality of cap assemblies (**140** and **150**) located at both sides of the length direction of the case **120**, as in an embodiment of the present disclosure, a space available for one cap assembly (**140** and **150**) may be reduced. Since the venting portion **130** may be formed on the case **120**, a degree of design freedom of the venting portion **130** may be improved, and discharging of gas in the case **120** may be improved. In the present document, the venting portion **130** formed on the first side surface **120***a* of the case **120** is illustrated, but is illustrative. For example, in another embodiment, the venting portion **130** may be located on the cap assembly (**140** and **150**).

[0046] According to an embodiment, the base **132** may be welded and coupled to the case **120** along an edge portion. The base **132** may be a plate including aluminum.

[0047] In an embodiment, the notch portion **131** may be a recess, a groove, and/or a hole, formed in the base **132**. The notch portion **131** may be a portion of the venting portion **130** that may be broken earlier than other portions, when pressure in the case **120** is higher than predetermined pressure. A thickness of at least a portion of the notch portion **131** may be thinner than a thickness of the base **132**.

[0048] According to the present disclosure, since at least a portion of gas generated in the case **120** may be discharged through an empty space of the venting portion **130** formed by rupture of the notch portion **131**, a direction of discharging gas may be controlled from the perspective of the battery cell **100**.

[0049] The tape **160** may be used for insulation of the case **120** of the battery cell **100**. For example, the tape **160** may include an insulating material. The tape **160** may be referred to as a protective film, a protective member, a protective tape, an insulating film, an insulating member, and/or an insulating tape. According to an embodiment, the tape **160** may include an adhesive material for coupling to the case **120** and the venting portion **130**.

[0050] The tape **160** may cover at least a portion of the case **120**. Although the tape **160** is illustrated in the present document as entirely covering the case **120**, a position in which the tape **160** covers the case **120** may be changed depending on a design. For example, in an embodiment, the tape **160** may cover at least a portion of the venting portion **130** and at least a portion of the first side surface **120***a* of the case **120**. In an embodiment, at least a portion of the tape **160** may be folded to overlap.

[0051] In an embodiment, a cover region **162** of the tape **160** may cover the venting portion **130**. After the notch portion **131** of the venting portion **130** is broken, at least a portion of the tape **160** (e.g., cover region **162**) may come into contact with at least a portion of venting gas passed through the notch portion **131** of the venting portion **130**. A path of gas generated from the venting portion **130** may be changed due to the cover region **162**.

[0052] In the present document, a structure in which the battery cell **100** is a square battery cell in which both directions are opened is illustrated, but is illustrative. For example, in an embodiment not illustrated, the battery cell **100** may be a square battery cell or a pouch-type battery cell in which a single direction is opened.

[0053] FIG. **3** is a schematic diagram illustrating an operation of a tape attachment device according to an embodiment. FIGS. **4**A and **4**B are schematic diagrams of a tape attachment device according to an embodiment.

[0054] Referring to FIGS. **3**, **4**A, and/or **4**B, a tape attachment device **200** may include a roller shaft **210** and a pressing member **220**. The tape attachment device **200** may apply external force to an object to adhere a tape to a surface. For example, the tape attachment device **200** may attach a tape **160** of a battery cell **100** to a case **120**. Descriptions of the battery cell **100**, the case **120**, and the tape **160** of FIG. **1** and/or FIG. **2** may be applied to the battery cell **100**, the case **120**, and the tape **160** of FIG. **3**.

[0055] In the present document, only a structure in which the tape attachment device **200** attaches the tape **160** to a surface of the case **120** of a square battery cell (e.g., battery cell **100** of FIG. **1**) in which both directions are opened is illustrated, but usage of the tape attachment device **200** is not limited thereto. For example, the tape attachment device **200** may be used to attach an insulating tape attached to a surface of a square battery cell **100** in which a single direction is opened, a tape for fixing a curved sealing portion of a pouch-type battery cell, or a tape used for connecting a plurality of battery cells.

[0056] The roller shaft **210** may be in contact with an insulating tape (e.g., tape **160**), and may closely contact the tape with an object (e.g., case **120**). When the surface of the case **120** is curved, a contact area between the roller shaft **210** and the tape **160** may be reduced, thereby reducing an adhesive force of the tape **160** to the case **120**.

[0057] The roller shaft **210** may include a first end portion **211** and a second end portion **212**. The roller shaft **210** may include an external circumferential surface **213** extending from the first end portion **211** to the second end portion **212**. The external circumferential surface **213** may be in contact with the tape **160**, to attach and adhere the tape **160** to the case **120**. As the tape **160** and the roller shaft **210** are in close contact with each other, air bubbles located between the tape **160** and the case **120** may be reduced.

[0058] The roller shaft **210** may be tilted in accordance with a shape of the case **120**. For example, the roller shaft **210** may be tilted by force or pressure provided from the pressing member **220**. The first end portion **211** and the second end portion **212** of the roller shaft **210** may be connected to the pressing member **220**, respectively.

[0059] The pressing member **220** may provide pressure or force to both end portions **211** and **212** of the roller shaft **210**. For example, the pressing member **220** may include a first cylinder **221** configured to move the first end portion **211**, and a second cylinder **222** configured to move the second end portion **212**. A position of the first end portion **211** may be changed based on movement of the first cylinder **221**. A position of the second end portion **212** may be changed based on movement of the second cylinder **222**. The positions of the first end portion **211** and/or the second end portion **212** may be changed to change a slope of the roller shaft **210**. According to an embodiment (e.g., FIG. **4**A), the first cylinder **221** may be connected to the first end portion **211**. The second cylinder **222** may be connected to the second end portion **212**. The roller shaft **210** may be tilted by a space located between components of the first cylinder **221** and/or a space located between components of the second cylinder **222**. For example, a position of the roller shaft **210** may be changed by clearance formed relative to the roller shaft **210**.

[0060] The second cylinder **222** may be disposed substantially parallel to the first cylinder **221**. For example, the first cylinder **221** and the second cylinder **222** may move in the first direction (e.g., X-axis direction), respectively.

[0061] The first cylinder **221** and the second cylinder **222** may be an air cylinder (e.g., pneumatic cylinder). However, this is illustrative, and the first cylinder **221** and the second cylinder **222** may be replaced with other components that may implement linear motion or piston motion, such as a hydraulic cylinder or an actuator.

[0062] According to an embodiment (e.g., FIG. **4**B), the tape attachment device **200** may include a guide member **230**. The guide member **230** may rotatably connect the roller shaft **210** to the pressing member **220**. For example, the guide member **230** may include a first guide member **231** rotatably connecting the first end portion **211** to the first cylinder **221**, and a second guide member **232** rotatably connecting the second end portion **212** to the second cylinder **222**. The first guide member **231** may include a first bearing support **231***a* coupled to the first cylinder **221**, and a first bearing **231***b* coupled to the first end portion **211**. The first bearing **231***b* may be rotatably coupled to the first bearing support **231***a*. For example, at least a portion of the first bearing **231***b* may rotate while being accommodated in the first bearing support **231***a*. The second guide member **232** may include a second bearing support **232***a* coupled to the second cylinder **222**, and a second bearing **232***b* coupled to the second end portion **212**. The second bearing **232***b* may be rotatably coupled to the second bearing support **232***a*. For example, at least a portion of the second bearing **232***b* may rotate while being accommodated in the second bearing support **232***a*.

[0063] The tape attachment device **200** may include at least one regulator **240** configured to control driving of the pressing member **220**. The regulator **240** may regulate pressure of the first cylinder **221** and pressure of the second cylinder **222**. The first cylinder **221** and the second cylinder **222** may operate independently, respectively. For example, the first cylinder **221** and the second cylinder **222** may be respectively connected to separate regulators **240**. According to an embodiment, the regulator **240** may include a first regulator **241** configured to regulate first pressure of the first cylinder **221**, and a second regulator **242** configured to regulate second pressure of the second cylinder **222**. A first stroke distance of the first cylinder **221** may be changed based on the first pressure regulated by the first regulator **241**, and a second stroke distance of the second cylinder **222** may be changed based on the second pressure regulated by the second regulator **242**. A slope of the roller shaft may be changed based on the first stroke distance and the second stroke distance. The first stroke distance and the second stroke distance may refer to distances that the first cylinder **221** and the second cylinder **222** move, relative to a reference position (e.g., position to which no pressure is applied), respectively.

[0064] The tape attachment device **200** may include a memory **250**.

[0065] The memory **250** may store external surface curvature data of the battery cell **100**. In an embodiment, the external surface curvature data may be data reflecting surface curvature of the case **120** of the square battery cell **100**. The external surface curvature data may be sensed using a distance sensor or the like. In another embodiment, the external surface curvature data may be data reflecting surface curvature of a curved sealing portion of a pouch-type battery cell. In yet another embodiment, the external surface curvature data may be data reflecting surface curvature of a cell assembly including a plurality of battery cells. The external surface curvature data may be measured using a sensor during a manufacturing process of the battery cell **100** and/or the cell assembly. The regulator **240** may regulate pressure of the pressing member **220** in response to the external surface curvature data stored in the memory **250**. For example, the regulator **240** may regulate at least one of the first pressure of the first cylinder **221** or the second pressure of the second cylinder **222**, based on the external

surface curvature data. The pressure of the first cylinder **221** and/or the pressure of the second cylinder **222** may be regulated by the regulator **240**, the slope of the roller shaft **210** may be changed.

[0066] According to an embodiment, the memory **250** may store a limit pressure value for preventing or reducing damage to the case **120** of the battery cell **100**.

[0067] According to an embodiment, the tape attachment device **200** may include a pressure sensor **260**. For example, the tape attachment device **200** may include a pressure sensor **260** disposed on the roller shaft **210**. The pressure sensor **260** may detect the pressure applied to the first end portion **211** and/or the second end portion **212** of the roller shaft **210**. Output of the pressing member **220** may be controlled based on a pressure value sensed by the pressure sensor **260** and the limit pressure value stored in the memory **250**. For example, the regulator **240** or a processor (not illustrated) may stop or reduce the output of the pressing member **220**, when a sensed pressure value exceeds the limit pressure value stored in the memory **250**. The output of the pressing member **220** may be limited by the pressure sensor **260**, to reduce or prevent damage to the battery cell **100**. In an embodiment, the pressure sensor **260** may be a load cell.

[0068] According to an embodiment, the first cylinder **221** and the second cylinder **222** may include a servo motor, respectively. For example, the tape attachment device **200** may further include a distance detection sensor (not illustrated) for sensing a surface of the case **120**. Driving (e.g., stroke) of the first cylinder **221** and the second cylinder **222** may be changed based on a value sensed by the distance detection sensor.

[0069] FIG. **5** is a flow chart of a tape attachment method according to an embodiment.

[0070] Referring to FIG. **5**, together with FIGS. **4**A and **4**B, a tape attachment method **300** may include a pressing operation **310** and a pressure regulating operation **320**. The tape attachment method **300** of FIG. **5** may be performed using the tape attachment device **200** of FIGS. **3**, **4**A, and/or **4**B.

[0071] The pressing operation **310** may be an operation of pressing a tape **160** using a roller shaft **210**. For example, an external circumferential surface **213** of the roller shaft **210** may provide pressure while contacting the tape **160**.

[0072] The pressure regulating operation **320** may be an operation of regulating at least one of pressure of a first cylinder **221** connected to a first end portion **211** of the roller shaft **210**, or pressure of a second cylinder **222** connected to a second end portion **212** of the roller shaft **210**. For example, a first regulator **241** may regulate the pressure of the first cylinder **221**, and a second regulator **242** may regulate the pressure of the second cylinder **222**.

[0073] The roller shaft **210** may be tilted by the pressure regulating operation **320**. For example, by the pressure regulating operation **320**, a first stroke distance of the first cylinder **221** and/or a second stroke distance of the second cylinder **222** may be changed. The first stroke distance and/or the second stroke distance may be changed to tilt the roller shaft **210**. The roller shaft **210** may be tilted to increase a contact area between the roller shaft **210** and an object having a curved surface. Due to the increase in the contact area, adhesive force of the tape **160** may be improved. According to an embodiment, the regulator **240** may regulate the pressure of the cylinders **221** and **222** based on the external surface curvature data of the battery cell **100** stored in the memory **250**.

[0074] A sequence of the pressing operation **310** and the pressure regulating operation **320** may be changed. For example, in FIG. **5**, the pressing operation **310** is illustrated as being performed before the pressure regulating operation **320**, but this is illustrative. The pressing operation **310** and the pressure regulating operation **320** may be performed simultaneously, or the pressure regulating operation **320** may be performed before the pressing operation **310**.

[0075] The contents described above are merely examples of applying principles of the present disclosure, and other configurations may be further included without departing from the scope of the present disclosure.

[0076] Although the embodiments of the present disclosure have been described above, the scope of the present disclosure is not limited thereto, and it will be apparent to those skilled in the art that various modifications and variations are possible within a scope that does not depart from the technical idea of the present disclosure as described in the claims. For example, the present disclosure may be implemented by deleting some of the components in the embodiments described above, and respective embodiments may be implemented in combination with each other.

[0077] According to an embodiment of the present disclosure, adhesive strength of a tape to an object having a curved surface may be improved.

[0078] Only specific examples of implementations of certain embodiments may be described. Variations, improvements and enhancements of the disclosed embodiments and other embodiments may be made based on the disclosure of this patent document.

What is claimed is:

1. A tape attachment device comprising:

a roller shaft including a first end portion and a second end portion opposite to the first end portion; and

a pressing member including a first cylinder connected to the first end portion, and a second cylinder connected to the second end portion and configured to operate independently of the first cylinder,

wherein the roller shaft is configured to tilt based on movement of the pressing member.

2. The tape attachment device of claim **1**, further a guide member including a first guide member comprising rotatably connecting the first end portion to the first cylinder, and a second guide member rotatably connecting the second end portion to the second cylinder.

3. The tape attachment device of claim **2**, wherein the first guide member includes a first bearing support coupled to the first cylinder, and a first bearing connected to the first end portion and rotatably coupled to the first bearing support, and

the second guide member includes a second bearing support coupled to the second cylinder, and a second bearing connected to the second end portion and rotatably coupled to the second bearing support.

4. The tape attachment device of claim **1**, further comprising:

a memory configured to store external surface curvature data; and

a regulator configured to regulate pressure of at least one of the first cylinder or the second cylinder, based on the external surface curvature data.

5. The tape attachment device of claim **4**, the regulator includes a first regulator configured to regulate first pressure of the first cylinder, and a second regulator configured to regulate second pressure of the second cylinder.

6. The tape attachment device of claim **5**, wherein a first stroke distance of the first cylinder is configured to be changed based on the first pressure, and a second stroke distance of the second cylinder is configured to be changed based on the second pressure, and

a slope of the roller shaft is configured to be changed based on the first stroke distance and the second stroke distance.

7. The tape attachment device of claim **1**, wherein the roller shaft is configured to provide external force to a tape, and includes an external circumferential surface located between the first end portion and the second end portion.

8. The tape attachment device of claim **1**, wherein the first cylinder and the second cylinder include at least one of a pneumatic cylinder, a hydraulic cylinder, or an actuator, respectively.

9. The tape attachment device of claim **1**, wherein the second cylinder is disposed parallel to the first cylinder.

10. The tape attachment device of claim **1**, further comprising:

a memory configured to store a limit pressure value; and

a pressure sensor disposed on the roller shaft,

wherein output of the pressing member is configured to be changed based on a pressure value sensed by the pressure sensor and the limit pressure value.

11. A tape attachment method comprising:

a pressing operation of pressing a tape using a roller shaft; and

a pressure regulating operation of regulating at least one of pressure of a first cylinder connected to a first end portion of the roller shaft, or pressure of a second cylinder connected to a second end portion of the roller shaft,

wherein the roller shaft is configured to tilt based on the pressure regulating operation.

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