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(54) **COVER OPENING AND CLOSING MECHANISM AND ELECTRONIC APPARATUS**

(75) Inventors: **Munetoyo Aono**, Matsumoto-shi (JP); **Yasuyuki Sakato**, Saku-shi (JP)

Correspondence Address:
WORKMAN NYDEGGER
(F/K/A WORKMAN NYDEGGER & SEELEY)
60 EAST SOUTH TEMPLE
1000 EAGLE GATE TOWER
SALT LAKE CITY, UT 84111 (US)

(73) Assignee: **SEIKO EPSON CORPORATION**, Tokyo (JP)

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(57) **ABSTRACT**

An opening and closing mechanism for a cover is openable and closable with respect to a body. The mechanism includes a link structure supported at the body rotatably within a range of a first predetermined angle from a closed state of the cover, and supporting the cover rotatably within a range of a second predetermined angle. The link structure is rotated integrally with the cover when being rotated within the range of the first predetermined range. The cover is solely rotated within the range of the second predetermined angle when the link structure has been rotated by the first predetermined angle from the closed state of the cover.

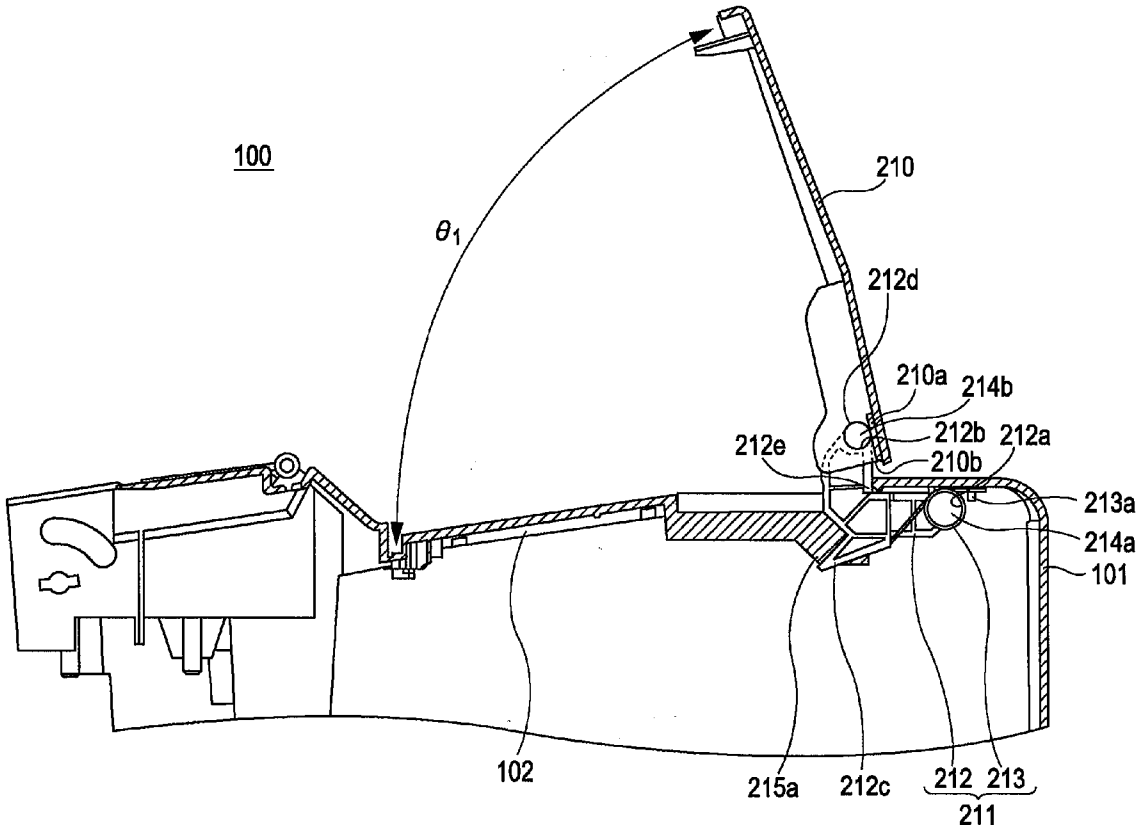


FIG. 1

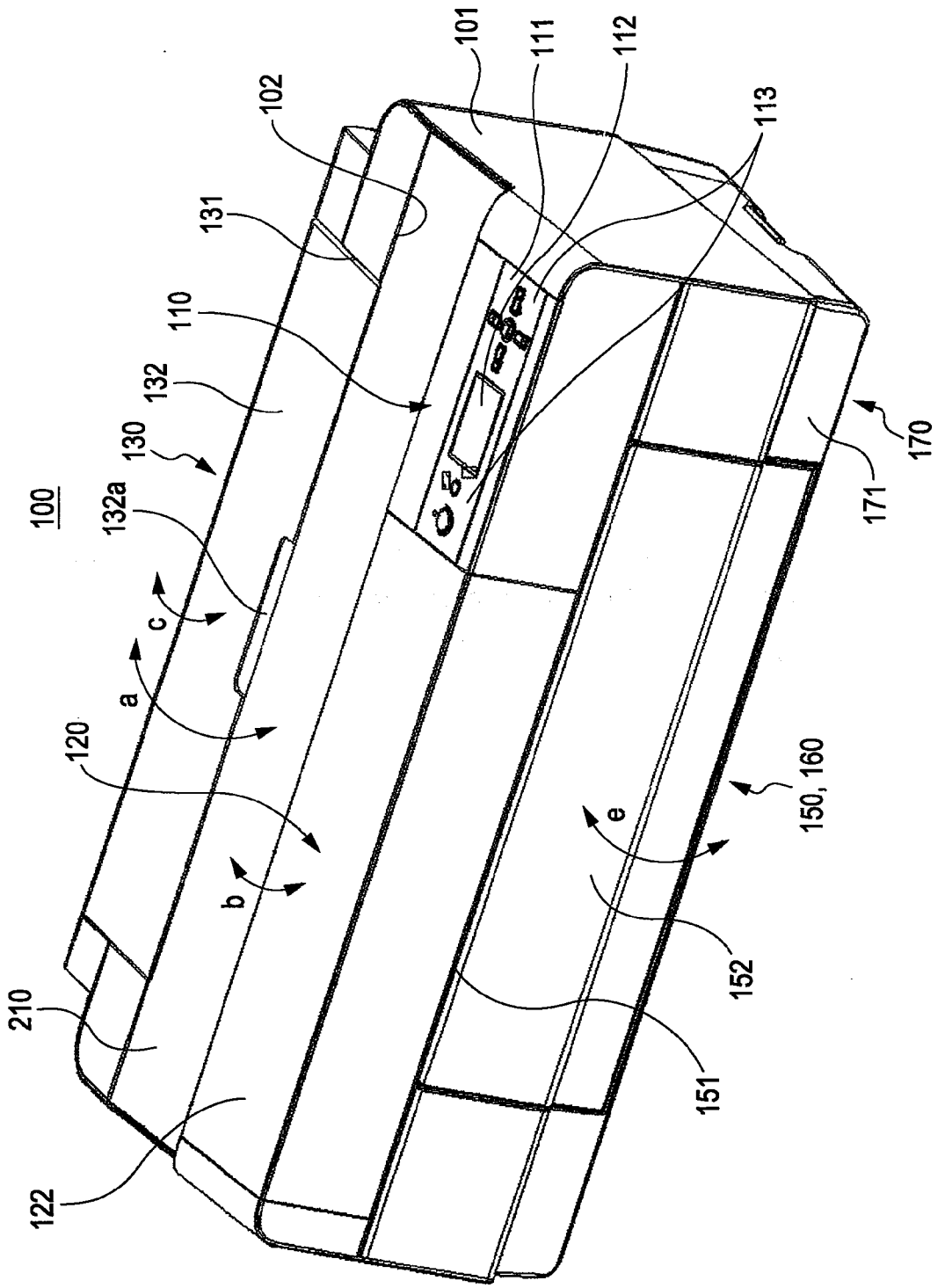

100
101
102
111
112
113
131
110
132
130
132a
170
171
a
b
c
d
e
120
150, 160
152
151
210
122

FIG. 2

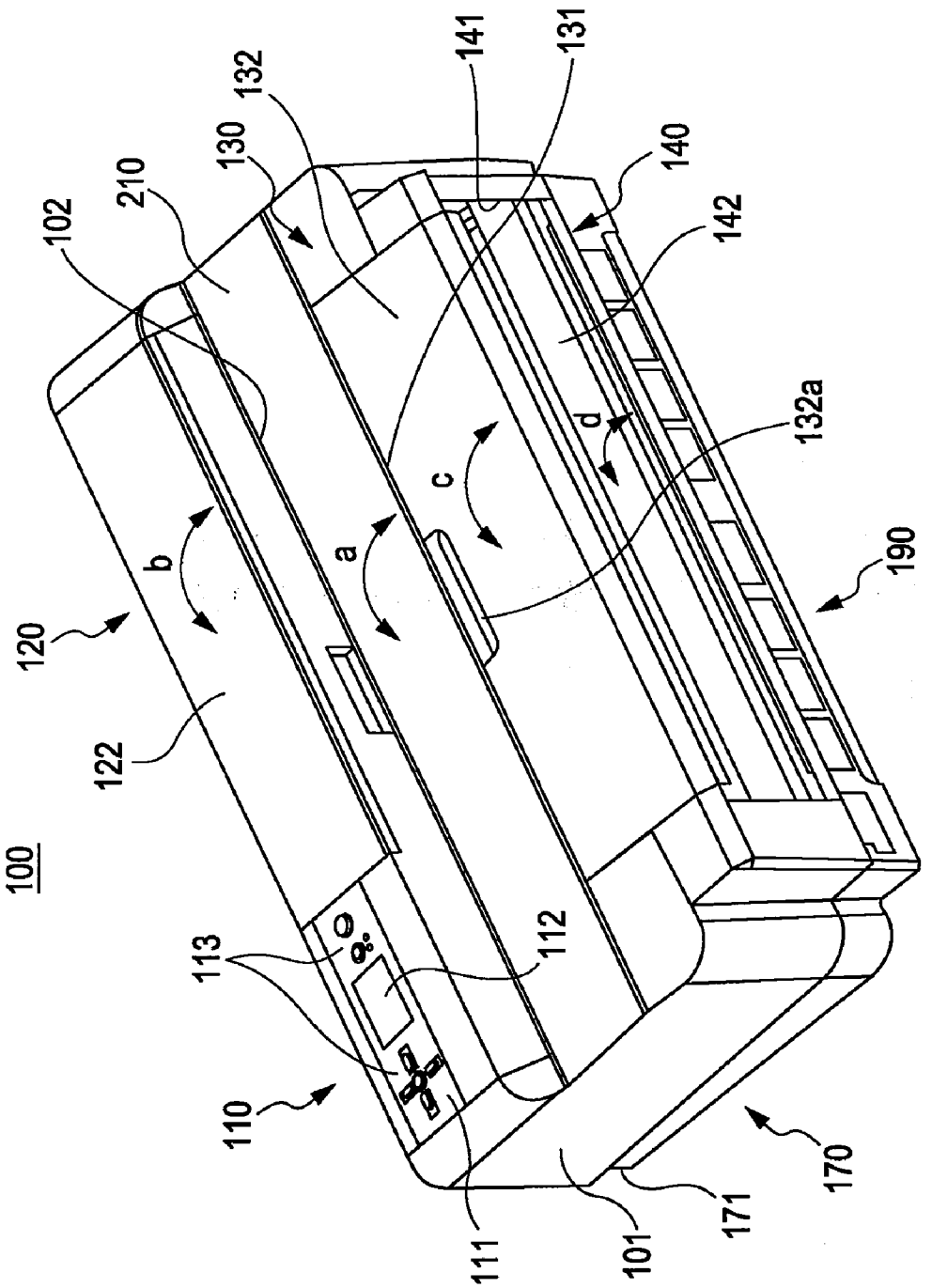

100
102
210
130
132
141
131
140
142
132a
190
120
122
110
113
112
111
101
171
170
a
b
c
d

FIG. 3

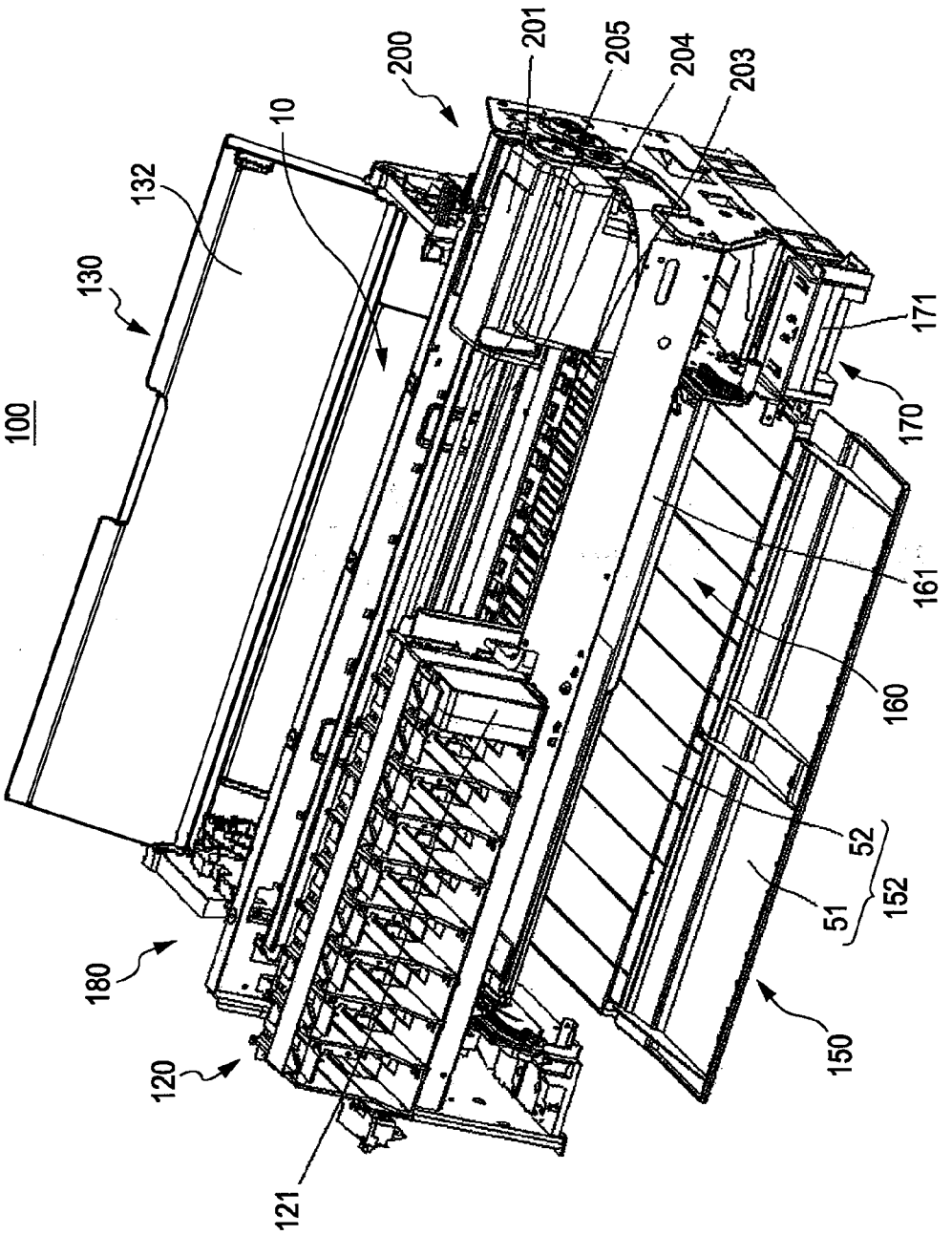

100
10
120
121
130
132
150
152
160
161
170
171
180
200
201
203
204
205
51
52

FIG. 4

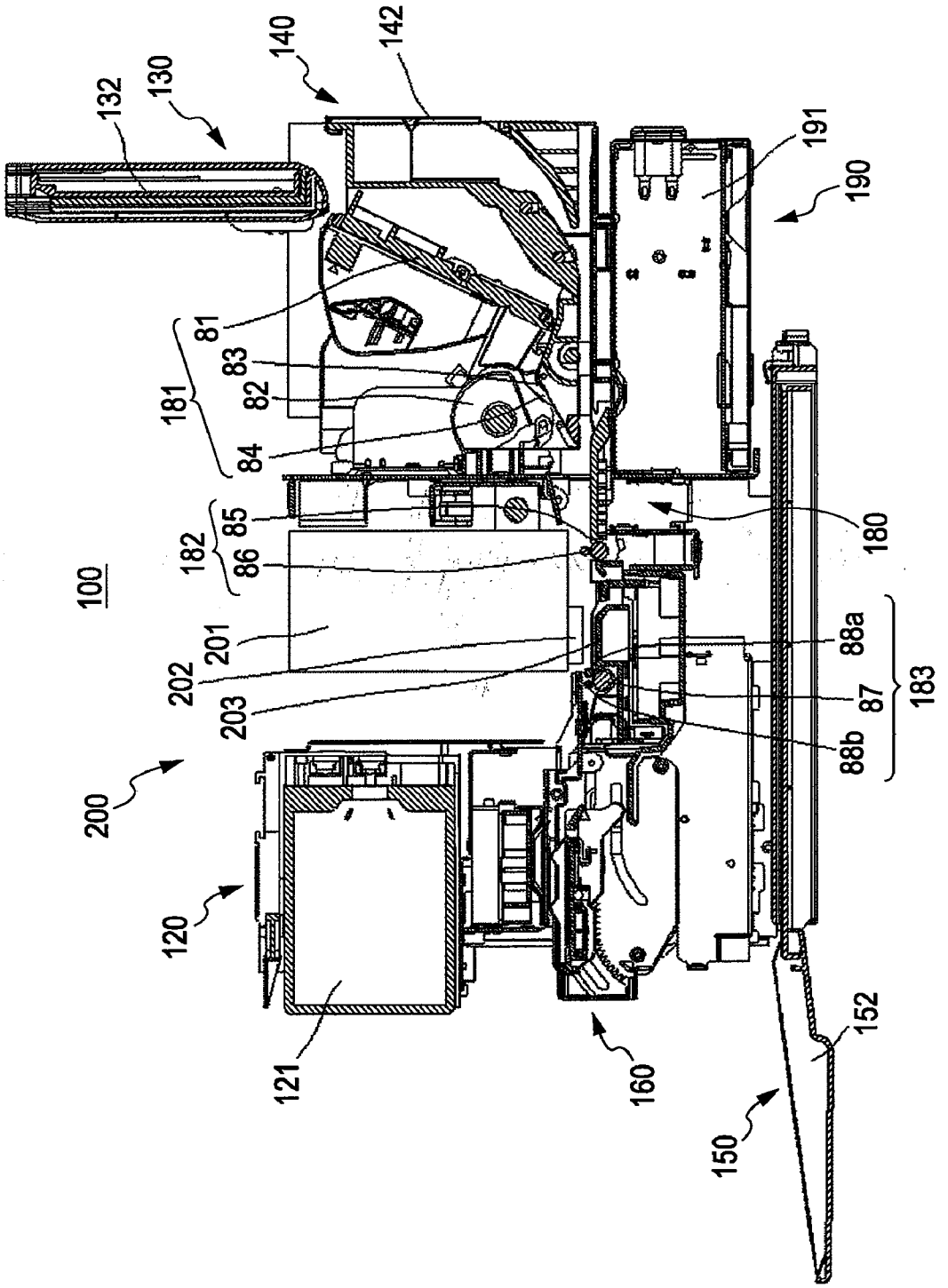

100
200
120
121
130
132
140
142
150
152
160
180
181
81
82
83
84
182
85
86
190
191
201
202
203
183
87
88a
88b

FIG. 5

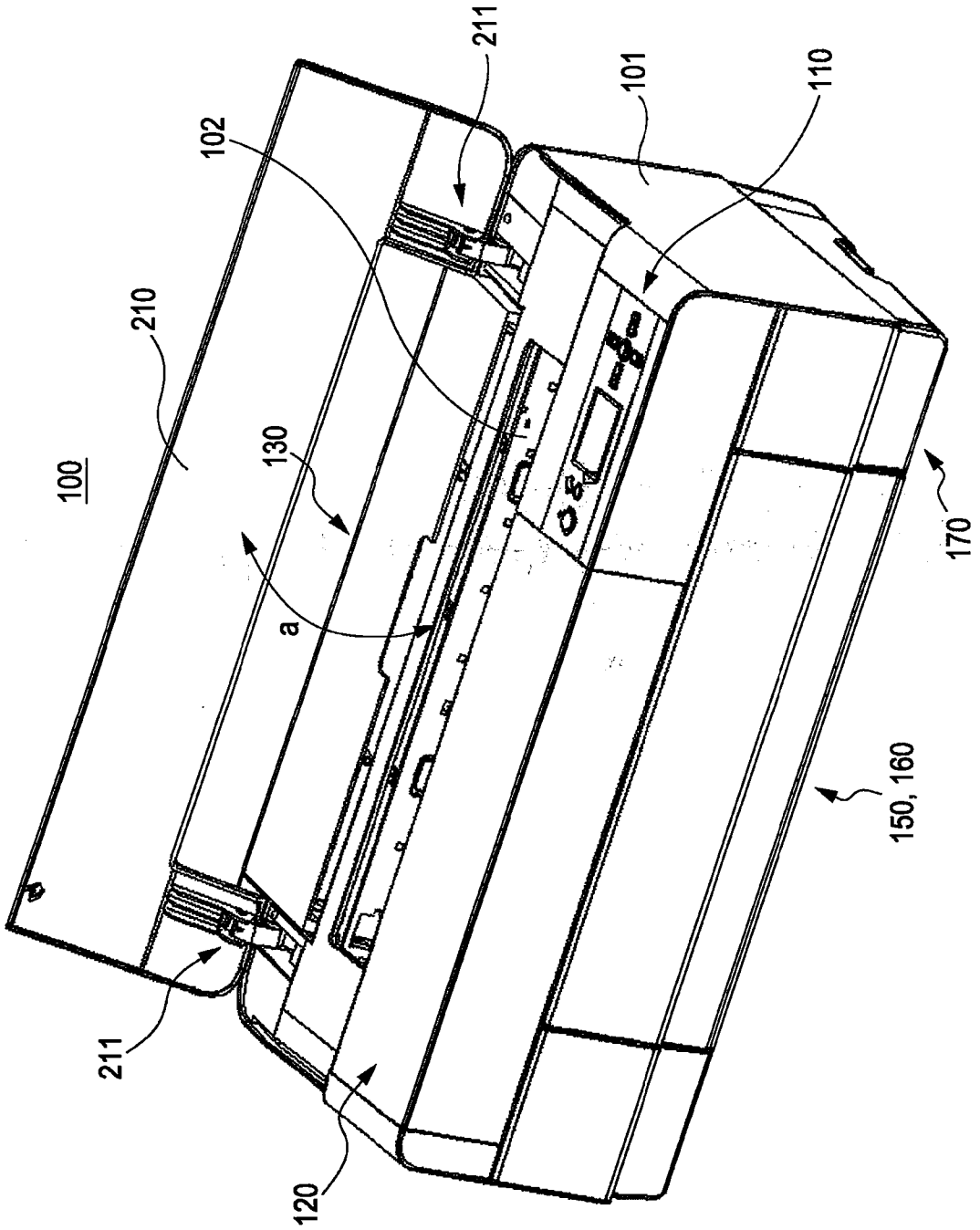
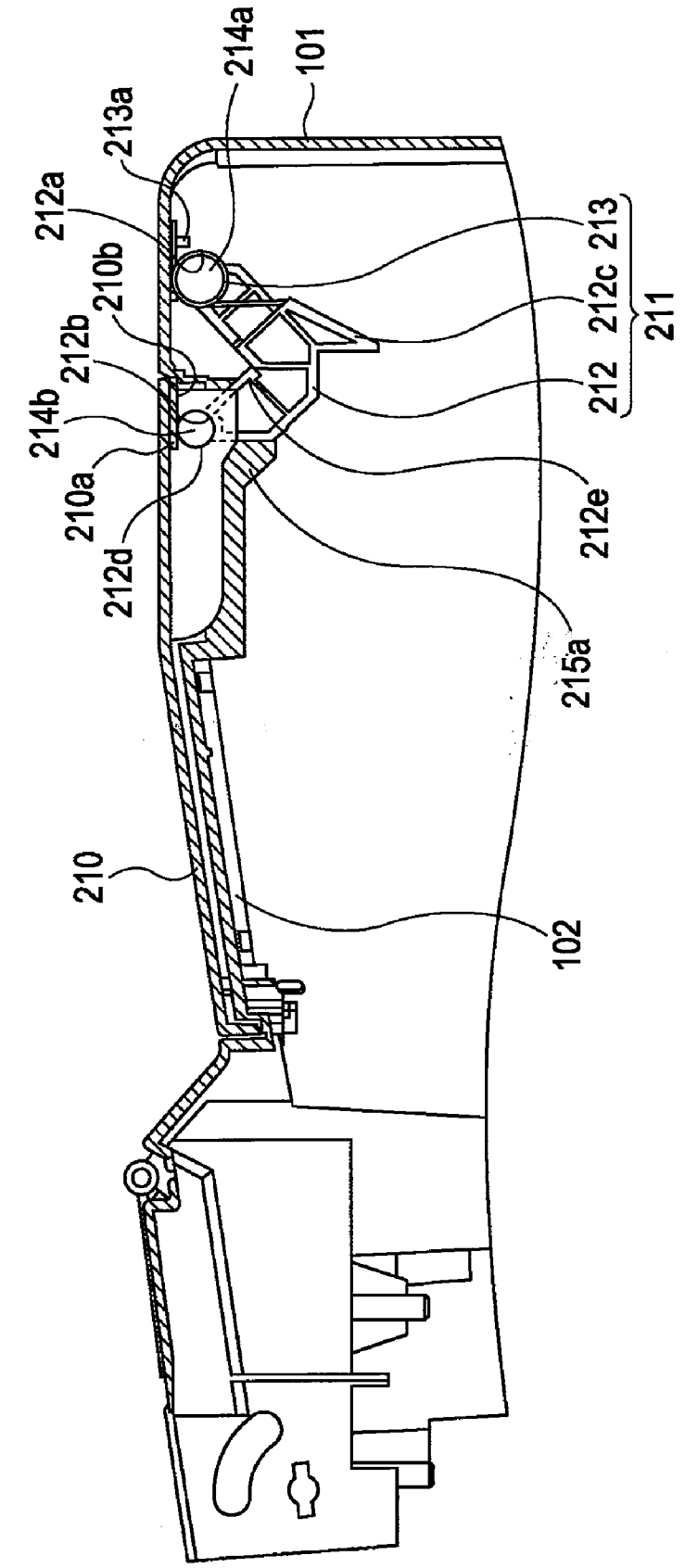


FIG. 6


100
214a
101
213a
212a
213
212c
211
210b
212b
212
214b
210a
212d
212e
215a
210
102

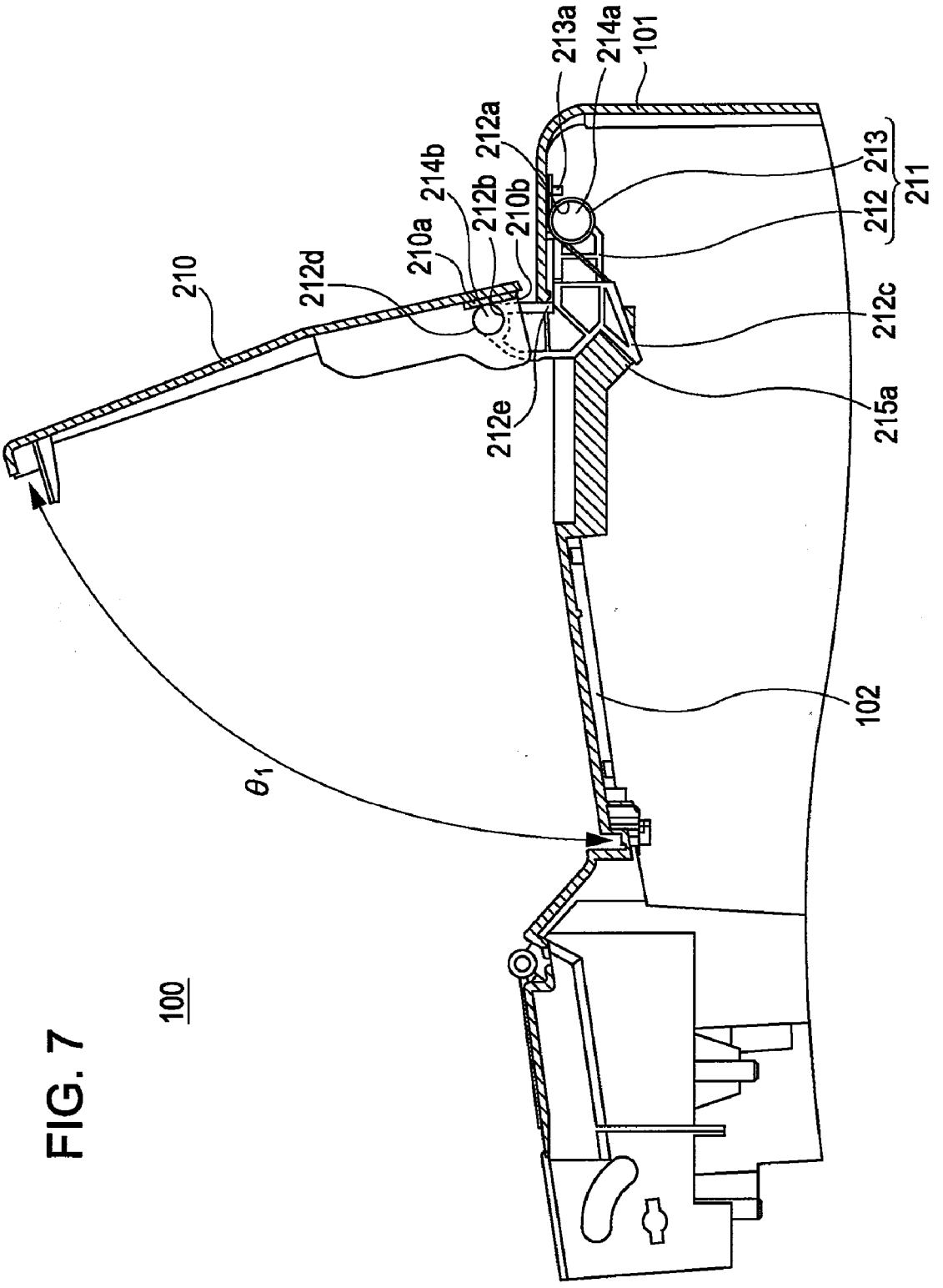

213a
214a
101
212a
214b
212b
210b
210a
210
212d
212e
213
212
211
212c
215a
102
θ_1
100

FIG. 7

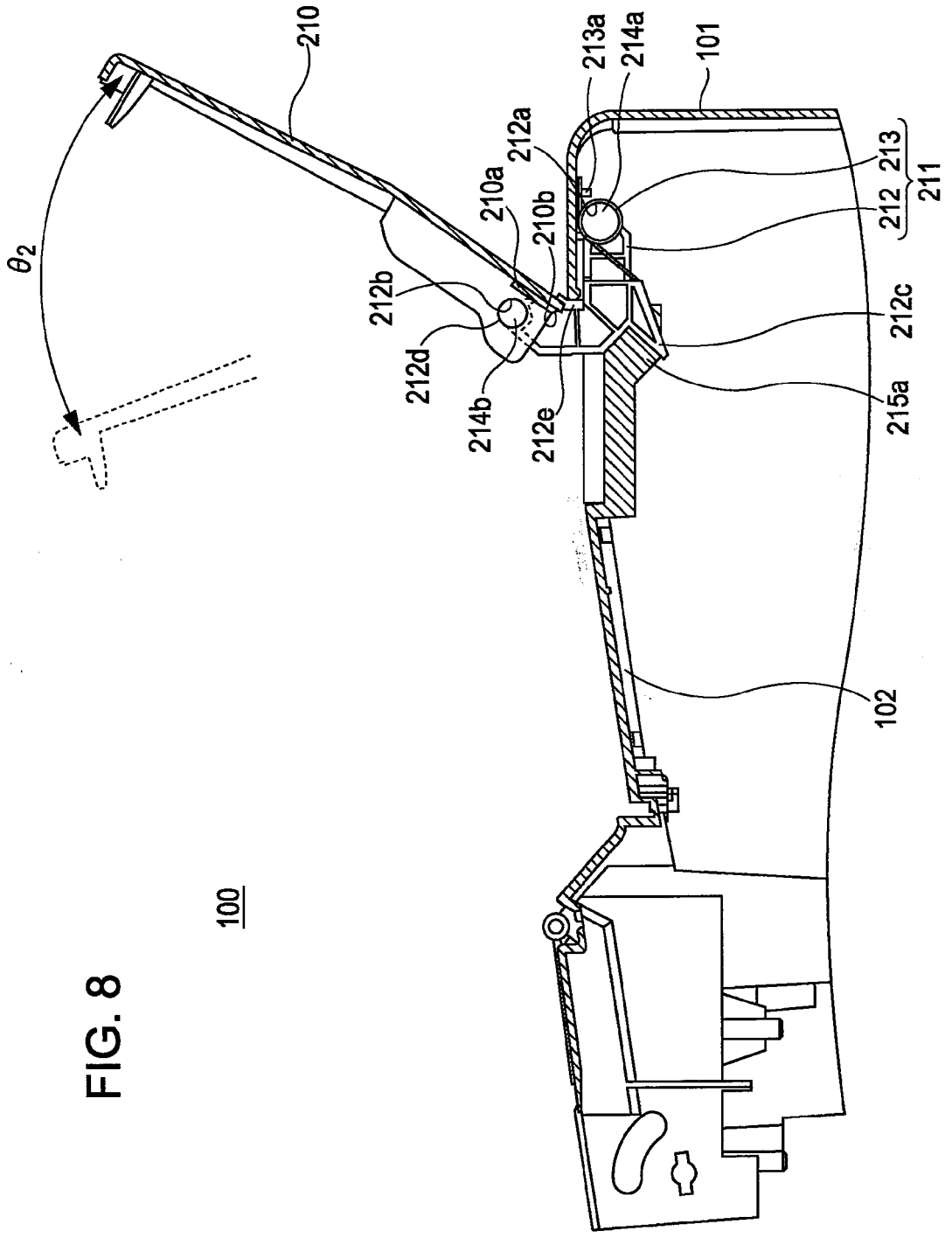
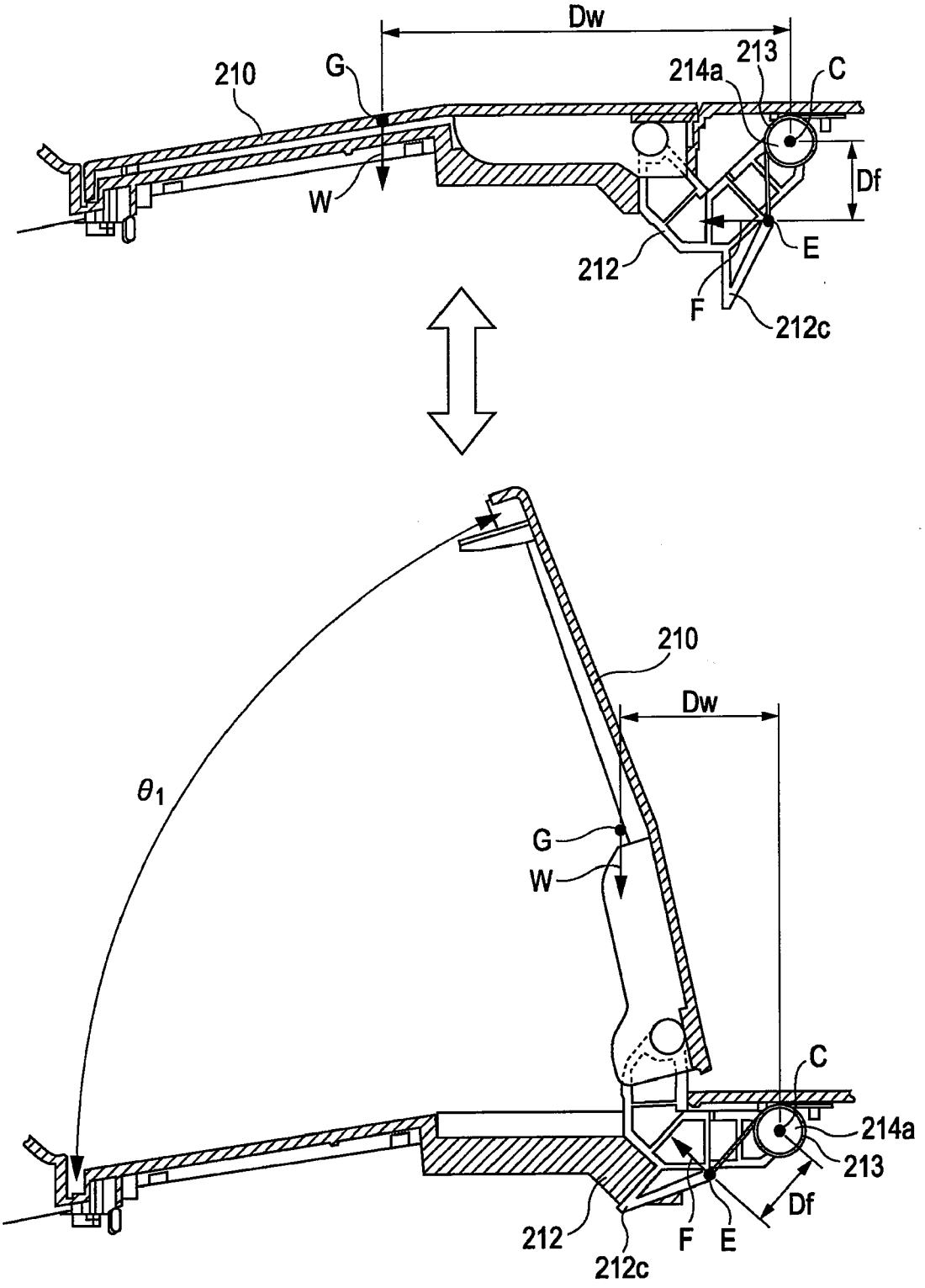

210
213a
214a
101
212a
210a
210b
212
213
211
θ_2
212b
212c
212d
214b
212e
215a
102
100

FIG. 8

FIG. 9


Dw
210
G
213
214a
C
W
Df
E
212
F
212c
θ1
210
Dw
G
W
C
214a
213
Df
212
F
E
212c

COVER OPENING AND CLOSING MECHANISM AND ELECTRONIC APPARATUS

BACKGROUND

[0001] 1. Technical Field

[0002] The present invention relates to an opening and closing mechanism for a cover openable and closable with respect to a body, and an electronic apparatus provided with the opening and closing mechanism for the cover.

[0003] 2. Related Art

[0004] An electronic apparatus usually has an opening at an upper surface of a housing to facilitate maintenance of the inside of the housing. Such an opening is necessary to be widely provided for facilitating the maintenance, but otherwise closed to prevent dust and the like from entering. Owing to this, the opening is covered with a cover that is rotated within a range of a large angle to open and close the opening.

[0005] An opening and closing mechanism for the cover may be a mechanism in which shafts protrude at both sides of one end of the cover while holes are formed both sides of one end of the opening, and the shafts are inserted to the holes to support the cover rotatably about the shafts. Alternatively, the opening and closing mechanism may be a mechanism in which one piece of a hinge is fixed at the one end of the cover with a screw or the like, while the other piece of the hinge is fixed at the one end of the opening with a screw or the like, and the cover is rotatably supported by the hinge (see JP-A-2005-41213).

[0006] However, with the opening and closing mechanism using the shafts and the holes, or that using the hinge, if a user releases his/her hand from the cover in the middle of opening the cover, the cover may be rapidly closed due to its weight and damaged. In addition, an interference range of the cover and the housing may increase due to the degree of opening of the cover, the thickness of the cover, and the like. Therefore, a relatively-large gap is required between the cover and the housing. Due to this, dust and the like likely enters the gap, and the housing needs to be designed such that the inside of the housing is not exposed through the gap.

[0007] To address those problems, a concealed hinge may be used. The concealed hinge has one end fixed to the back surface of the cover with a screw or the like, and the other end supported at the inner surface of the housing rotatably about a shaft and biased with a torsion coil spring. However, the opening is necessary to be rotated within a range of a large angle to open and close the opening, the concealed hinge may increase in size, and hence, the rotation space for the concealed hinge must be widely secured in the housing. Accordingly, it is difficult to downsize the electronic apparatus.

SUMMARY

[0008] An advantage of some aspects of the invention is that a small opening and closing mechanism for a cover with a sufficient opening and closing angle, and an electronic apparatus provided with the opening and closing mechanism for the cover are provided.

[0009] An opening and closing mechanism for a cover according to an aspect of the invention is openable and closable with respect to a body. The mechanism includes a link structure supported at the body rotatably within a range of a first predetermined angle from a closed state of the cover, and supporting the cover rotatably within a range of a second predetermined angle. The link structure is rotated integrally with the cover when being rotated within the range of the first predetermined range. The cover is solely rotated within the range of the second predetermined angle when the link structure has been rotated by the first predetermined angle from the closed state of the cover.

[0010] An opening and closing mechanism for a cover according to another aspect of the invention is openable and closable with respect to a body. The mechanism includes a link having at one end a first hinge supported at the body side, and having at the other end a second hinge supported at the cover side. When the cover is open, the cover is integrally rotated with the link about the first hinge by a first predetermined angle, then the cover is solely rotated about the second hinge by a second predetermined angle, and the cover is maintained in an open state. When the cover is closed, the cover is solely rotated about the second hinge by the second predetermined angle, then the cover is integrally rotated with the link about the first hinge by the first predetermined angle, and the cover is maintained in a closed state. With this configuration, since the cover is opened and closed by the link structure having the two supporting points, the cover can be widely opened without interfering with the body even if the link structure decreases particularly in height. In addition, since the link structure is downsized, it would not interfere with the main components in the body, so that the main components may be more desirably arranged.

[0011] Preferably, the link may include a biasing unit for biasing the cover in its opening direction by a moment substantially equivalent to a moment caused by a weight of the cover when the cover is rotated in the opening direction about the first hinge by the first predetermined angle. With this configuration, the cover can be maintained in the opening state when the cover has reached the first predetermined angle, and also, even when a user releases his/her hand from the cover in the middle of opening the cover toward the first predetermined angle, the cover may be closed slowly. Preferably, the link and the cover may have rotation restrictors that restrict the rotation of the cover and the link when the cover and the link have been rotated by the first predetermined angle, and rotation restrictors that restrict the rotation of the cover when the cover has been rotated by the second predetermined angle. With this configuration, the cover can be always open at accurate angles. Preferably, the first and second hinges may be disposed not to protrude from the body when the cover is in the closed state. With this configuration, the entire body can be designed compactly.

[0012] An electronic apparatus according to still another aspect of the invention includes the above-mentioned opening and closing mechanism for the cover. Preferably, the electronic apparatus may be a recording device that performs a recording operation on a recording medium. With this configuration, there can be provided the electronic apparatus and the recording medium which may attain the above-described advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

[0014] FIG. **1** is a perspective view showing the diagonally front side of the exterior of an ink jet printer which is an example of a recording device according to an embodiment of the invention.

[0015] FIG. **2** is a perspective view showing the diagonally rear side of the exterior of the printer shown in FIG. **1**.

[0016] FIG. **3** is a perspective view generally showing the interior of the printer shown in FIG. **1**.

[0017] FIG. **4** is a lateral cross section generally showing the interior of the printer shown in FIG. **1**.

[0018] FIG. **5** is a perspective view showing the front side of the printer shown in FIG. **1** in a state where a printer cover is open.

[0019] FIG. **6** is a first lateral cross section showing transition from a state where the printer cover shown in FIG. **5** is closed to a state where the printer cover is open.

[0020] FIG. **7** is a second lateral cross section showing the transition from the state where the printer cover shown in FIG. **5** is closed to a state where the printer cover is open.

[0021] FIG. **8** is a third lateral cross section showing the transition from the state where the printer cover shown in FIG. **5** is closed to a state where the printer cover is open.

[0022] FIG. **9** is an illustration showing the action of a torsion coil spring of the printer cover shown in FIG. **5**.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0023] An exemplary embodiment of the invention will be described below with reference to the attached drawings. Note that the below-described embodiment does not restrict the invention pertaining to claims, and the solution of the invention may not necessitate all of the combinations of features mentioned in the embodiment.

[0024] FIGS. **1** and **2** are perspective views showing the diagonally front and rear sides of the exterior of an ink jet printer which is an example of a recording device according to an embodiment of the invention. FIG. **3** is a perspective view generally showing the interior thereof. FIG. **4** is a lateral cross section generally showing the interior thereof. This ink jet printer **100** can perform a recording operation on a cut-sheet (hereinafter, referred to as "sheet", corresponding to a recording medium) with ink. A variety of sizes is available for such a sheet, such as Japanese photo paper sizes including L, 2L, and postcard; and Japanese Industrial Standards (JIS) A series sizes including A4, slightly larger than A3, and A2.

[0025] As shown in FIGS. **1** and **2**, the ink jet printer **100** is entirely covered with a housing (body) **101** being substantially a rectangular parallelepiped. An operation unit **110** is disposed at the upper right side of the housing **101** (shown in FIG. **1**), and a cartridge accommodating unit **120** is disposed at the upper left side (shown in FIG. **1**) thereof. A first rear sheet feeding unit **130** is disposed at the upper rear side (shown in FIG. **1**). A second rear sheet feeding unit **140** is disposed at the rear side (shown in FIG. **2**). A sheet discharging unit **150** and a front sheet feeding unit **160** are disposed at the front side (shown in FIG. **1**). A waste ink recovering unit **170** is disposed at the front right side (shown in FIG. **1**). Provided inside the ink jet printer **100** are a controlling unit **190** (shown in FIGS. **2** and **4**), and a sheet transporting unit **180** and a recording unit **200** (shown in FIGS. **3** and **4**).

[0026] In addition, a rectangular opening **102** is formed at the upper surface of the housing **101** between the first rear sheet feeding unit **130**, and the operation unit **110** and the cartridge accommodating unit **120**. The opening **102** is covered with a printer cover (cover) **210** which is a substantially rectangular plate. The printer cover **210** is mounted rotatably in the directions of the illustrated double-headed arrow a by a cover opening and closing mechanism **211** (see FIG. **5**), a characteristic portion of the invention. A user can easily perform maintenance for the internal mechanisms, such as the sheet transporting unit **180** and the recording unit **200**, through the opening **102** by lifting the printer cover **210** and uncovering the opening **102**. The cover opening and closing mechanism **211** will be described later in detail.

[0027] As shown in FIGS. **1** and **2**, the operation unit **110** includes a substantially rectangular operation panel **111**. A liquid crystal panel **112** is disposed substantially at the center of the operation panel **111** and displays an operation state and the like. Buttons **113** are disposed on both sides of the liquid crystal panel **112**, for a power system that turns power ON/OFF, an operation system that performs positioning of the leading edge of a sheet or flushing of ink, and for a processing system that performs image processing. Since the user can operate the buttons **113** while checking the liquid crystal panel **112**, it is possible to prevent an erroneous operation.

[0028] As shown in FIGS. **1** and **2**, the cartridge accommodating unit **120** accommodates ink cartridges **121** (shown in FIGS. **3** and **4**) in a detachably attached manner. The ink cartridges **121** store ink of print colors (nine print colors in the embodiment). The cartridge accommodating unit **120** is covered with a cartridge cover **122** that is L-shaped in cross section. The cartridge cover **122** is mounted rotatably in the directions of the illustrated double-headed arrow b around a rotary shaft provided at its rear end. The user can easily replace the ink cartridges **121** by lifting the cartridge cover **122** and uncovering the cartridge accommodating unit **120**, thereby improving working efficiency.

[0029] The first rear sheet feeding unit **130** is designated as automatic sheet feed (ASF). As shown in FIGS. **1** and **2**, the first rear sheet feeding unit **130** includes a first sheet support **132** having a four-stage structure and involving a function of opening and closing a rectangular first sheet feeding opening **131** extended upward and a function of supporting one or a plurality of sheets to be fed. The first sheet support **132** is mounted rotatably in the directions of the illustrated double-headed arrow c around a rotary shaft provided at its rear end. The sheets to be fed by the first rear sheet feeding unit **130** are relatively thin (for example, plain paper or photo paper of about 0.08 to 0.27 mm in thickness).

[0030] Before the use of the ink jet printer **100**, the user may complete setting of the first sheet support **132** by placing a finger at a hole **132***a*, which is provided at the front

center of the first sheet support **132**, lifting the first sheet support **132**, and drawing the multistage portion. Accordingly, the first sheet support **132** need not be stored or maintained unlike a removable sheet support. In addition, the first sheet support **132** has the multistage structure, whereby it may reliably support a variety of sizes of sheets to be fed. After the use of the ink jet printer **100**, the first sheet feeding opening **131** can be closed by pushing the multistage portion of the first sheet support **132**. Accordingly, it is possible to prevent dust from entering the printer body, and to store the first sheet support **132** compactly.

[**0031**] The second rear sheet feeding unit **140** is designated as manual sheet feed. As shown in FIG. **2**, the second rear sheet feeding unit **140** includes a second sheet support **142** having a two-stage structure and involving a function of opening and closing a rectangular second sheet feeding opening **141** extended rearward and a function of supporting one sheet to be fed. The second sheet support **142** is mounted rotatably in the directions of the illustrated double-headed arrow d around a rotary shaft provided at its lower end. The sheet to be fed by the second rear sheet feeding unit **140** is a sheet having a thickness that cannot be fed at a transportation angle in the first rear sheet feeding unit **130** (for example, drawing paper or special paper of about 0.29 to 0.48 mm in thickness). Since the first rear sheet feeding unit **130** is designated as the automatic sheet feed (ASF), it picks up a sheet by a sheet feeding roller **82**. If paper dust adheres to the sheet feeding roller **82**, the sheet feeding roller **82** may slip off a sheet and cause misfeed of the sheet. Therefore, sheets tending to produce paper dust (such as velvet Fine Art Paper of about 0.48 mm in thickness, and Ultra Smooth Fine Art Paper of about 0.46 mm in thickness, both produced by Seiko Epson Corporation) are also need to be manually fed by the second rear sheet feeding unit **140**.

[**0032**] Before the use of the ink jet printer **100**, the user may complete setting of the second sheet support **142** by placing a finger at an upper portion of the second sheet support **142**, bringing down the second sheet support **142**, and drawing the multistage portion. Accordingly, the second sheet support **142** need not be stored or maintained unlike a removable sheet support. In addition, the second sheet support **142** has the multistage structure, whereby it may reliably support a variety of sizes of sheets to be fed. After the use of the ink jet printer **100**, the second sheet feeding opening **141** can be closed by pushing the multistage portion of the second sheet support **142**. Accordingly, it is possible to prevent dust from entering the printer body, and to store the second sheet support **142** compactly.

[**0033**] As shown in FIG. **1**, the sheet discharging unit **150** includes a stacker **152** having a two-stage structure. The stacker **152** includes a first stacker portion **51** and a second stacker portion **52** (shown in FIG. **3**) involving a function of opening and closing a rectangular sheet discharging opening **151** extended forward and a function of stacking one or a plurality of sheets to be discharged. The first stacker portion **51** is mounted rotatably in the directions of the illustrated double-headed arrow e around a rotary shaft provided at the front end of the second stacker portion **52**. The second stacker portion **52** is mounted so as to protrude and be accommodated by moving in parallel and obliquely vertically with respect to the sheet discharging opening **151**.

[**0034**] Before the use of the ink jet printer **100**, the user may, complete setting of the stacker **152** by placing a finger at the upper portion of the first stacker portion **51**, rotating the first stacker portion **51** forward, uncovering the sheet discharging opening **151**, pinching the front end of the first stacker portion **51** with fingers, drawing the first stacker portion **51**, moving the second stacker portion **52** in parallel and obliquely upward to protrude. Accordingly, the stacker **152** need not be stored or maintained unlike a removable stacker. In addition, the stacker **152** has the multistage structure, whereby it may reliably stack a variety of sizes of sheets to be discharged. Also, the recorded sheets are always discharged from the front side, whereby the user may easily take out the sheets. After the use of the ink jet printer **100**, the sheet discharging opening **151** can be closed by manually pushing the first end of the first stacker portion **51**, moving the second stacker portion **52** in parallel and obliquely downward to be accommodated, placing a hand at the first stacker portion **51**, and rotating the first stacker portion **51** rearward. Accordingly, it is possible to prevent dust from entering the printer body, and to store the stacker **152** compactly.

[**0035**] The front sheet feeding unit **160** is designated as manual sheet feed. As shown in FIG. **3**, the front sheet feeding unit **160** includes a sheet feeding tray **161** disposed above the stacker **152** in the sheet discharging opening **151**. The sheet feeding tray **161** is provided horizontally movably with respect to the sheet discharging opening **151**. Sheets to be fed by the front sheet feeding unit **160** are sheets that are relatively thick and cannot be bent when transporting them (for example, matte board paper of about 1.2 mm in thickness).

[**0036**] Before the use of the ink jet printer **100**, when the user lightly pushes the first end of the sheet feeding tray **161**, a stopper of the sheet feeding tray **161** is disengaged and the sheet feeding tray **161** protrudes from the sheet discharging opening **151**. After the use of the ink jet printer **100**, when the user lightly pushes the first end of the sheet feeding tray **161**, the stopper of the sheet feeding tray **161** is engaged and the sheet feeding tray **161** is accommodated in the sheet discharging opening **151**. Therefore, the sheet feeding tray **161** may efficiently save the space to be disposed.

[**0037**] As shown in FIGS. **1** to **3**, the waste ink recovering unit **170** accommodates a waste ink tank **171** in a detachably attached manner. The waste ink tank **171** which stores waste ink and the like. The waste ink tank **171** stores the waste ink and the like that is exhausted when a recording head **202** is cleaned or the ink cartridges are replaced. When the waste ink tank **171** is filled with the waste ink and the like, the user draws out the waste ink tank **171** and inserts another waste ink tank **171**, thereby facilitating the replacement of the waste ink tank **171**.

[**0038**] As shown in FIGS. **3** and **4**, the sheet transporting unit **180** extends from the first rear sheet feeding unit **130** and the second rear sheet feeding unit **140** to the sheet discharging unit **150**. The sheet transporting unit **180** includes an automatic sheet feeding mechanism **181**, a transporting mechanism **182**, and a sheet discharging mechanism **183**. As shown in FIG. **4**, the automatic sheet feeding mechanism **181** includes a hopper **81**, a sheet feeding roller **82**, a retard roller **83**, and a sheet returning lever **84**. The hopper **81** lifts up sheets supported by the first sheet support **132** to feed them. The sheet feeding roller **82** takes out the sheets lifted by the hopper **81**. The retard roller

83 separates one of the sheets double-fed by the sheet feeding roller **82**. The sheet returning lever **84** returns the residual sheets separated by the retard roller **83** to the hopper **81**.

[**0039**] The hopper **81** is platy to allow sheets to be placed thereon, and is disposed substantially in parallel to a rear wall. The lower end of the hopper **81** is positioned near the sheet feeding roller **82**, and the upper end thereof is positioned near the top portion of the rear wall. A compression spring (not shown) has one end attached to the rear wall and the other end attached to the back surface at the lower end of the hopper **81**. The hopper **81** is disposed so that the lower end of the hopper **81** is turnable around its upper end due to expansion and compression of the compression spring.

[**0040**] The sheet feeding roller **82** has a D shape since a portion of its cross section is cut out, and is disposed near the lower end of the hopper **81**. The sheet feeding roller **82** rotates intermittently to frictionally feed the sheets that are lifted by the hopper **81**. The retard roller **83** is disposed to abut on or be separated from the sheet feeding roller **82**, thereby frictionally separating only the topmost one of the sheets when the sheets are double-fed by the sheet feeding roller **82**. The sheet returning lever **84** is formed like a pawl and is disposed near the sheet feeding roller **82**. The residual sheets that have been separated by the retard roller **83** are caught by the pawl to return them to the hopper **81**.

[**0041**] As shown in FIG. **4**, the transporting mechanism **182** includes a sheet feeding roller **85** and a driven roller **86**, which transport sheets in a sub-scanning direction in synchronism with a recording operation. The sheet feeding roller **85** is disposed upstream of a platen **203** in the sheet transportation direction. The sheet feeding roller **85** and the driven roller **86** pinch a sheet that is fed by the sheet feeding roller **82** to send the sheet to the platen **203**.

[**0042**] As shown in FIG. **4**, the sheet discharging mechanism **183** includes a sheet discharging roller **87**, a first serrated roller **88***a*, and a second serrated roller **88***b*. The first serrated roller **88***a* is disposed downstream of the platen **203** in the sheet transportation direction. The second serrated roller **88***b* and the sheet discharging roller **87** are disposed downstream of the first serrated roller **88**a in the sheet transportation direction to oppose each other. The sheet that has passed the platen **203** is discharged by the first serrated roller **88***a* and then, and pinched by the second serrated roller **88***b* and the sheet discharging roller **87** to be discharged onto the stacker **152**. The first serrated roller **88***a* and the second serrated roller **88***b* are held by the same holding member (not shown).

[**0043**] As shown in FIG. **4**, the controlling unit **190** includes a main substrate **191** that constitutes a printer controller. Though not shown, the main substrate **191** has controlling elements and storage elements, such as a CPU, ROM, RAM, or ASIC, and other circuit elements. The controlling unit **190** controls the sheet transporting unit **180**, the recording unit **200**, and the like, of a print engine.

[**0044**] As shown in FIG. **4**, the recording unit **200** includes a carriage **201** that moves in a main-scanning direction in synchronism with a recording operation, the recording head **202** that discharges ink in synchronism with the recording operation, and the platen **203** that holds the sheet in a flat state during the recording. As shown in FIG. **3**, the carriage **201** passes through a carriage guide shaft **204** above the platen **203** and is connected to a carriage belt **205**. When the carriage belt **205** is operated by a carriage motor (not shown), the carriage **201** is moved by the movement of the carriage belt **205** and is guided along the carriage guide shaft **204**, so that it reciprocates.

[**0045**] As shown in FIG. **4**, the recording head **202** is mounted to the carriage **201** so that a predetermined interval is provided between the recording head **202** and the platen **203**. The recording head **202** can discharge ink of two types of black, such as photo-black and matte black, and ink of seven colors, yellow, cyan, light cyan, magenta, light magenta, gray, and red. In other words, the recording head **202** includes a nozzle plate having a pressure generating chamber and a nozzle connected to the pressure generating chamber. An ink droplet having a controlled size is discharged towards the sheet from the nozzle by storing the ink in the pressure generating chamber and applying a predetermined pressure thereto. The platen **203** is disposed between the sheet feeding roller **85** and the sheet discharging roller **87** so as to oppose the recording head **202**, and supports a surface of the sheet that is being transported. Next, the cover opening and closing mechanism **211**, a characteristic portion of the invention, will be described in more detail with reference to the drawings.

[**0046**] FIG. **5** is a perspective view showing the front side of the printer in a state where the printer cover **210** is open. FIGS. **6** to **8** are lateral cross sections each showing transition from a state where the printer cover **210** is closed to a state where it is open. As shown in FIG. **5**, the cover opening and closing mechanism **211** is disposed at either side of the first rear sheet feeding unit **130**. As shown in FIG. **6**, one end of the cover opening and closing mechanism **211** is rotatably attached at the inner side of the upper surface of the housing **101**, while the other end thereof is rotatably attached at the back surface at the rear end of the printer cover **210**.

[**0047**] Each cover opening and closing mechanism **211** includes a substantially L-shaped link (link structure) **212** and a torsion coil spring (biasing unit) **213**. The link **212** has holes (link structure, first and second hinges) **212***a* and **212***b* at its both ends. A shaft (link structure, first hinge) **214***a* is provided at the inner side of the upper surface of the housing **101**, inserted through the hole (link structure, first hinge) **212***a* provided at one end of the link **212**, and rotatably supported by the hole **212***a*. A shaft (link structure, second hinge) **214***b* is provided at the back surface at the rear end of the printer cover **210**, inserted through the hole (link structure, second hinge) **212***b* provided at the other end of the link **212**, and rotatably supported by the hole **212***b*.

[**0048**] Additionally, the link **212** has a substantially triangular protruded portion (rotation restrictor) **212***c* provided at the outer side of the angular part of the L-shaped portion. The torsion coil spring **213** is inserted to the shaft **214***a* provided at the inner side of the upper surface of the housing **101**. One end of the torsion coil spring **213** is engaged at a protrusion **213***a* provided at the inner side of the upper surface of the housing **101**, while the other end thereof is engaged at the protruded portion **212***c* provided at the link **212**.

[**0049**] With this configuration, the printer cover **210** forms a double-hinge mechanism that is rotatable about the two shafts **214***a* and **214***b*. In particular, the link **212** is supported

rotatably within a range of a first predetermined angle (about 90 degrees) θ**1** defined between the printer cover **210** in a closed state shown in FIG. **6** and that in a half-open state shown in FIG. **7**. Besides, the printer cover **210** is supported rotatably within a range of a second predetermined angle (about 45 degrees) θ**2** defined between the printer cover **210** in the half-open state shown in FIG. **7** and that in a full-open state shown in FIG. **8**.

[**0050**] Within the first predetermined angle θ**1**, a rib (rotation restrictor) **210***a* provided at the back surface at the rear end of the printer cover **210** abuts on the other end portion (rotation restrictor) **212***d* of the link **212** to restrict rotation of the printer cover **210**. When the printer cover **210** has been rotated by the first predetermined angle θ**1** from the closed state, namely, to the half-open state, the protruded portion (rotation restrictor) **212***c* of the link **212** abuts on a wall (rotation restrictor) **215***a* provided at the housing **101** to restrict the rotation of the link **212**. In addition, when the printer cover **210** has been rotated by the second predetermined angle θ**2** from the half-open state, namely, to the full-open state, an edge portion (rotation restrictor) **210***b* provided at a lower end of the printer cover **210** abuts on a center portion (rotation restrictor) **212***e* of the link **212** to restrict the rotation of the printer cover **210**. As described above, the printer cover **210** is integrally rotated with the link **212** in the range between the closed state shown in FIG. **6** and the half-open state shown in FIG. **7**. Then, the printer cover **210** is solely rotated in the range between the half-open state shown in FIG. **7** and the full-open state shown in FIG. **8**.

[**0051**] Note that the printer cover **210** is rotatably supported by the link **212** not just in the range between the half-open state shown in FIG. **7** and the full-open state shown in FIG. **8**. The printer cover **210** may-be rotated with respect to the link **212** within the range of the second predetermined angle **02**. Therefore, when the printer cover **210** is lifted from the closed state shown in FIG. **6**, the printer cover **210** would not be integrally rotated with the link **212**, and the printer cover **210** is solely rotated to the second predetermined angle θ**2**. To avoid this, the torsion coil spring **213** is provided.

[**0052**] FIG. **9** is an illustration showing the action of the torsion coil spring **213**. The torsion coil spring **213** is attached to apply a biasing force in the opening direction of the printer cover **210**. The biasing force F is determined in relation to a weight W of the printer cover **210** including the link **212**. Specifically, a moment Mf acting on the link **212** including the printer cover **210** caused by the biasing force F of the torsion coil spring **213** is expressed by a product of the biasing force F of the torsion coil spring **213** and a distance Df from a central point C of the shaft **214***a* inserted to the hole **212***a* at the one end of the link **212** to an engagement point E at which the other end of the torsion coil spring **213** is engaged with respect to the protruded portion **212***c* of the link **212**, i.e., Mf=F×Df.

[**0053**] Meanwhile, a moment Mw acting on the link **212** including the printer cover **210** caused by the weight W of the printer cover **210** including the link **212**-is expressed by a product of the weight W of the printer covert **210** including the link **212** and a distance Dw from the central point C of the shaft **214***a* inserted to the hole **212***a* at the one end of the link **212** to the center of gravity G of the printer cover **210** including the link **212**, i.e., Mw=W×Dw.

[**0054**] Since the distance Df is constant, the above-expressed moment Mf is also constant. However, since the distance Dw is linearly varied in the range between the closed state and the half-open state of the printer cover **210**, the moment Mw is also linearly varied. Therefore, The biasing force F of the torsion coil spring **213** is determined so that the minimum moment Mw, namely, the moment Mw when the printer cover **210** is in the half-open state, is substantially equivalent with the inversely acting moment Mf.

[**0055**] Accordingly, when the user opens the printer cover **210**, the moment Mf in the opening direction is applied, and hence the user can easily lift up and rotate the printer cover **210** with the link **212** until the protruded portion **212***c* of the link **212** abuts on the wall **215***a* of the housing **101** and thus the rotation of the printer cover **210** with the link **212** is restricted. When the printer cover **210** becomes the half-open state, even if the user releases his/her hand from the printer cover **210**, the printer cover **210** is maintained in the half-open state since the moment Mf and the moment Mw substantially equivalently act in the opening and closing directions, respectively.

[**0056**] When the user pushes the printer cover **210** rearward, the protruded portion **212***c* of the link **212** abuts on the wall **215***a* provided at the housing **101** and thus the rotation of the link **212** is restricted. Accordingly, the printer cover **210** may be solely moved rearward until the edge portion **210***b* abuts on the center portion **212***e* of the link **212** and thus the rotation of the printer cover **210** is restricted. When the printer cover **210** becomes the full-open state, even if the user releases his/her hand from the printer cover **210**, the printer cover **210** is maintained in the full-open state since the moment Mf and the moment Mw substantially equivalently act in the opening direction, respectively.

[**0057**] On the other hand, when the user closes the printer cover **210**, he/she pulls the printer cover **210** forward to be the half-open state until the rib **210***a* of the printer cover **210** abuts on the other end portion **212***d* of the link **212** and thus the rotation of the printer cover **210** is restricted. Then, the printer cover **210** is further pushed down. At this time, the printer cover **210** can be easily closed since the moment Mw is applied in the closing direction. When the printer cover **210** becomes the closed state, even if the user releases his/her hand from the printer cover **210**, the printer cover **210** is maintained in the closed state since the moment Mw, which is larger than the moment Mf, is applied in the closing direction.

[**0058**] As described above, the cover opening and closing mechanism **211** according to the embodiment includes the link **212** having the one end supported at the housing **101** side provided with the hole **212***a* and the shaft **214***a*, and the other end supported at the printer cover **210** side provided with the hole **212***b* and the shaft **214***b*. When the printer cover **210** is open, the printer cover **210** and the link **212** are integrally rotated about the hole **212***a* and the shaft **214***a* by the first predetermined angle θ**1**, then the printer cover **210** is solely rotated about the hole **212***b* and the shaft **214***b* by the second predetermined angle θ**2**, and the printer cover **210** is maintained in the open state. On the other hand, when the printer cover **210** is closed, the printer cover **210** is solely rotated about the hole **212***b* and the shaft **214***b* by the second predetermined angle θ**2**, then the printer cover **210** and the

link **212** are integrally rotated about the hole **212***a* and the shaft **214***a* by the first predetermined angle θ**1**, and the printer cover **210** is maintained in the closed state. Accordingly, since the printer cover **210** is opened and closed by the link structure including the elements **212**, **212***a*, **214***a*, **212***b* and **214***b*, the printer cover **210** can be widely opened without interfering with the housing **101** even if the link structure including the elements **212**, **212***a*, **214***a*, **212***b* and **214***b* decrease particularly in height. In addition, since the link structure including the elements **212**, **212***a*, **214***a*, **212***b* and **214***b* may be downsized, those would not interfere with the main components in the ink jet printer **100**, so that the main components may be more desirably arranged.

[**0059**] Further, since the link **212** includes the torsion coil spring **213** for biasing the link **212** including the printer cover **210** in the opening direction by the moment Mf that is substantially equivalent with the moment Mw caused by the weight W of the printer cover **210** including the link **212** when the link **212** is rotated about the hole **212***a* and the shaft **214***a* by the first predetermined angle θ**1**. Accordingly, the printer cover **210** can be maintained in the opening state at the first predetermined angle θ**1**, and also, even when the user releases his/her hand from the printer cover **210** in the middle of opening the printer cover **210** toward the first predetermined angle θ**1**, the printer cover **210** may be closed slowly.

[**0060**] Further, the link **212** includes the other end portion **212***d* that restricts the rotation of the printer cover **210** when it is rotated by the first predetermined angle θ**1**, and the protruded portion **212***c* that restricts the rotation of the printer cover **210** when it has been rotated by the first predetermined angle θ**1**. Besides, the printer cover **210** includes the rib **210***a* that restricts the sole rotation of the printer cover **210** when it is rotated by the first predetermined angle θ**1**, and the edge portion **210***b* that restricts the rotation of the printer cover **210** when it has been rotated by the second predetermined angle θ**2**. Accordingly, the printer cover **210** can be always open at accurate angles. Further, the link **212** is disposed in the housing **101**, and hence, the holes **212***a* and **212***b*, and the shafts **214***a* and **214***b* are disposed to be invisible from the outside and not to protrude from the housing **101**. Accordingly, the entire ink jet printer **100** can be designed compactly.

[**0061**] While the ink jet printer is described above as an example of a recording device provided with the cover opening and closing mechanism, the recording device may be a facsimile, a copier, or the like, as long as it is provided with the cover opening and closing mechanism. The cover opening and closing mechanism may not be applied to the recording device, and may be applied to any kind of electric apparatuses.

What is claimed is:

1. An opening and closing mechanism for a cover openable and closable with respect to a body, the mechanism comprising:

a link structure supported at the body rotatably within a range of a first predetermined angle from a closed state of the cover, and supporting the cover rotatably within a range of a second predetermined angle, wherein

the link structure is rotated integrally with the cover when being rotated within the range of the, first predetermined range, and

the cover is solely rotated within the range of the second predetermined angle when the link structure has been rotated by the first predetermined angle from the closed state of the cover.

2. An opening and closing mechanism for a cover openable and closable with respect to a body, the mechanism comprising:

a link having at one end a first hinge supported at the body side, and having at the other end a second hinge supported at the cover side, wherein

when the cover is open, the cover is integrally rotated with the link about the first hinge by a first predetermined angle, then the cover is solely rotated about the second hinge by a second predetermined angle, and the cover is maintained in an open state, and

when the cover is closed, the cover is solely rotated about the second hinge by the second predetermined angle, then the cover is integrally rotated with the link about the first hinge by the first predetermined angle, and the cover is maintained in a closed state.

3. The opening and closing mechanism for the cover according to claim 2, wherein the link includes a biasing unit for biasing the cover in its opening direction by a moment substantially equivalent to a moment caused by a weight of the cover when the cover is rotated in the opening direction about the first hinge by the first predetermined angle.

4. The opening and closing mechanism for the cover according to claim 2, wherein the link and the cover have rotation restrictors that restrict the rotation of the cover and the link when the cover and the link have been rotated by the first predetermined angle, and the rotation of the cover when the cover has been rotated by the second predetermined angle.

5. The opening and closing mechanism for the cover according to claim 2, wherein the first and second hinges are disposed not to protrude from the body when the cover is in the closed state.

6. An electronic apparatus comprising the opening and closing mechanism for the cover according to claim 1.

7. The electronic apparatus according to claim 6, wherein the electronic apparatus is a recording device that performs a recording operation on a recording medium.

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