US 20140294607A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0294607 A1**

(43) **Pub. Date: Oct. 2, 2014**

MIYAZAKI

(54) **LIQUID TRANSPORTING APPARATUS AND LIQUID TRANSPORTING METHOD**

(71) Applicant: **SEIKO EPSON CORPORATION**, Tokyo (JP)

(72) Inventor: **Hajime MIYAZAKI**, Matsumoto-shi (JP)

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

(21) Appl. No.: **14/242,047**

(22) Filed: **Apr. 1, 2014**

(30) **Foreign Application Priority Data**

Apr. 2, 2013 (JP) 2013-076630

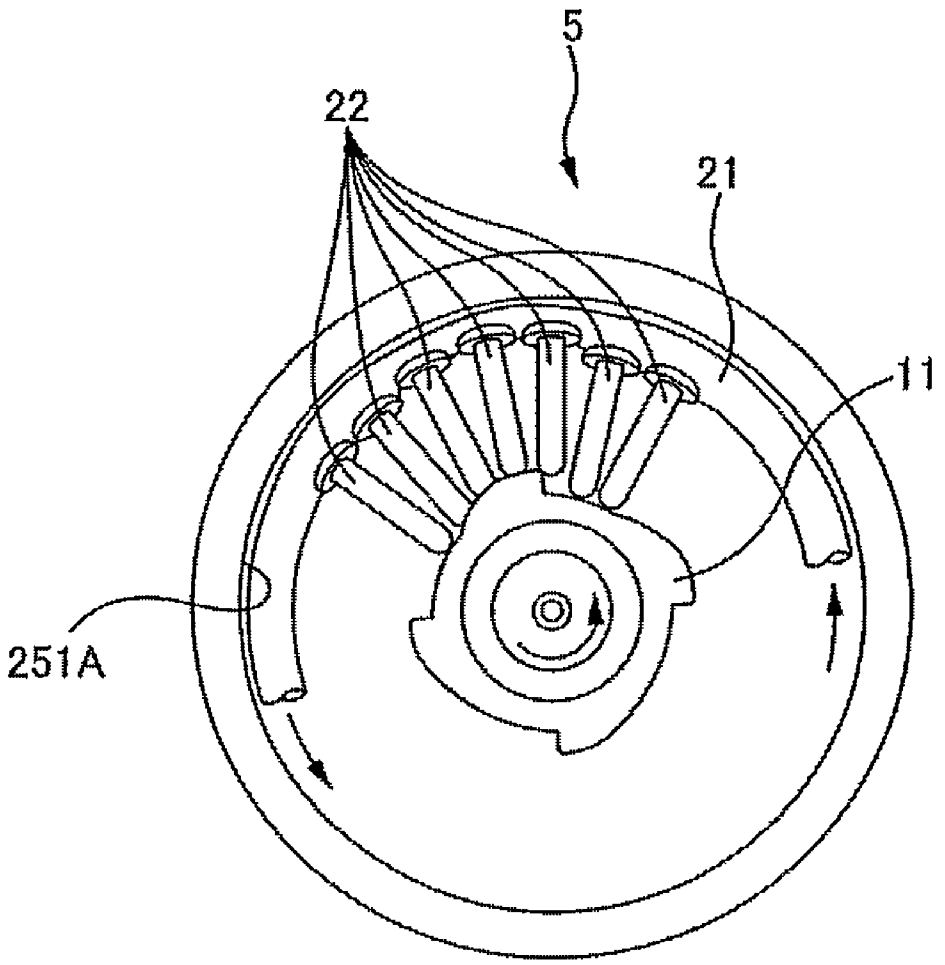
Publication Classification

(51) **Int. Cl.**
F04B 43/00 (2006.01)

(52) **U.S. Cl.**
CPC ***F04B 43/0081*** (2013.01)
USPC **417/53**; 417/212

(57) **ABSTRACT**

An operation of a liquid transporting apparatus is controlled by communication using a controller, and the power consumption during communication standby is reduced. The liquid transporting apparatus includes a liquid storage section that stores a liquid; a body section that is connected to the liquid storage section when transporting the liquid; a body control section that controls an operation of a driving section having at least a part of function for transporting the liquid. The body control section determines whether the body section and the liquid storage section are connected. If it is determined that the body section and the liquid storage section are connected, the communication between the body control section and an external control section that performs instruction to control the operation of the driving section starts.



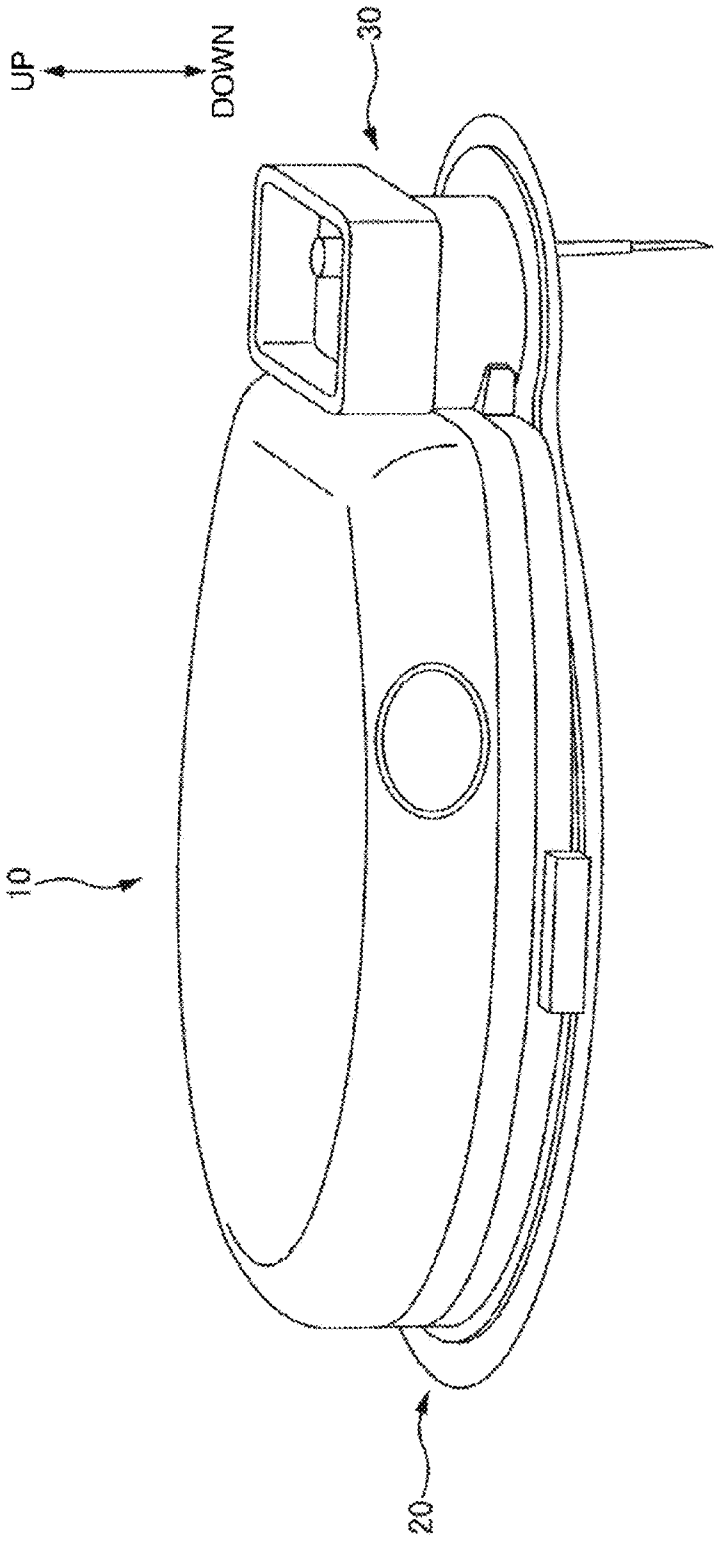


FIG. 1

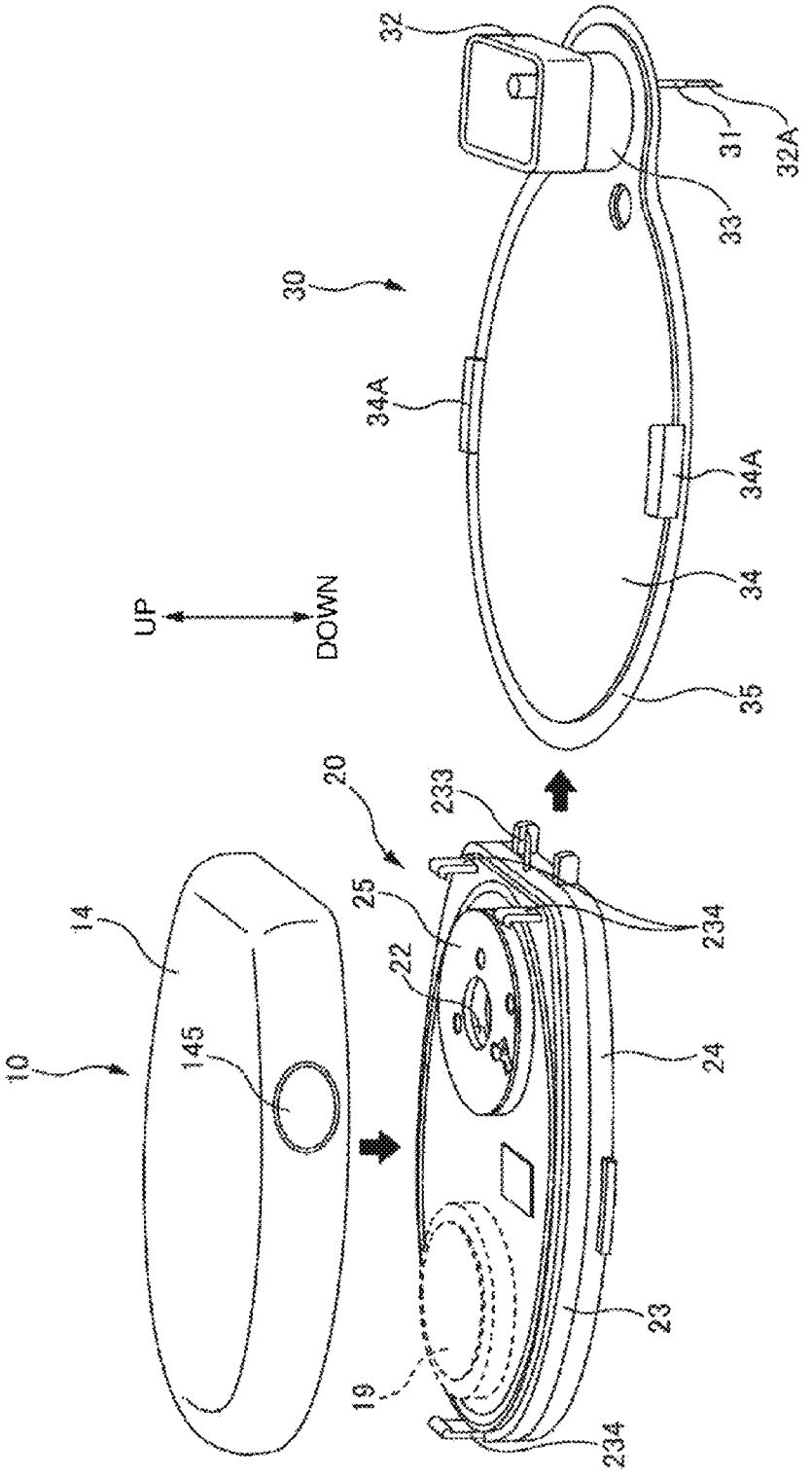

32
31
32A
33
30
34A
34A
34
35
UP
DOWN
20
233
25
234
22
14
145
10
24
23
19
234

FIG. 2

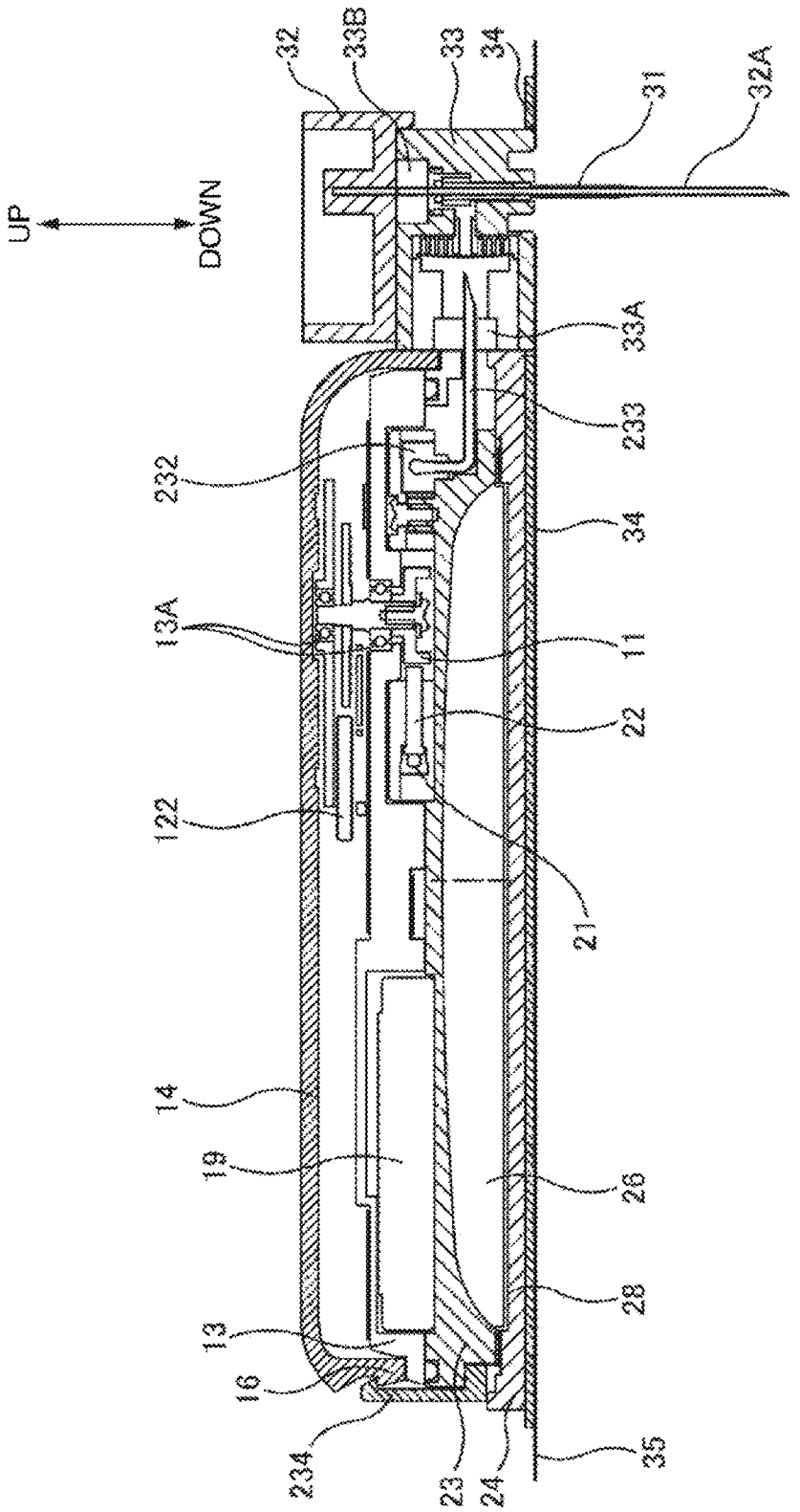

UP
DOWN
32
33B
33
34
31
32A
33A
233
232
34
13A
11
22
122
21
14
19
26
28
13
16
234
23
24
35

FIG. 3

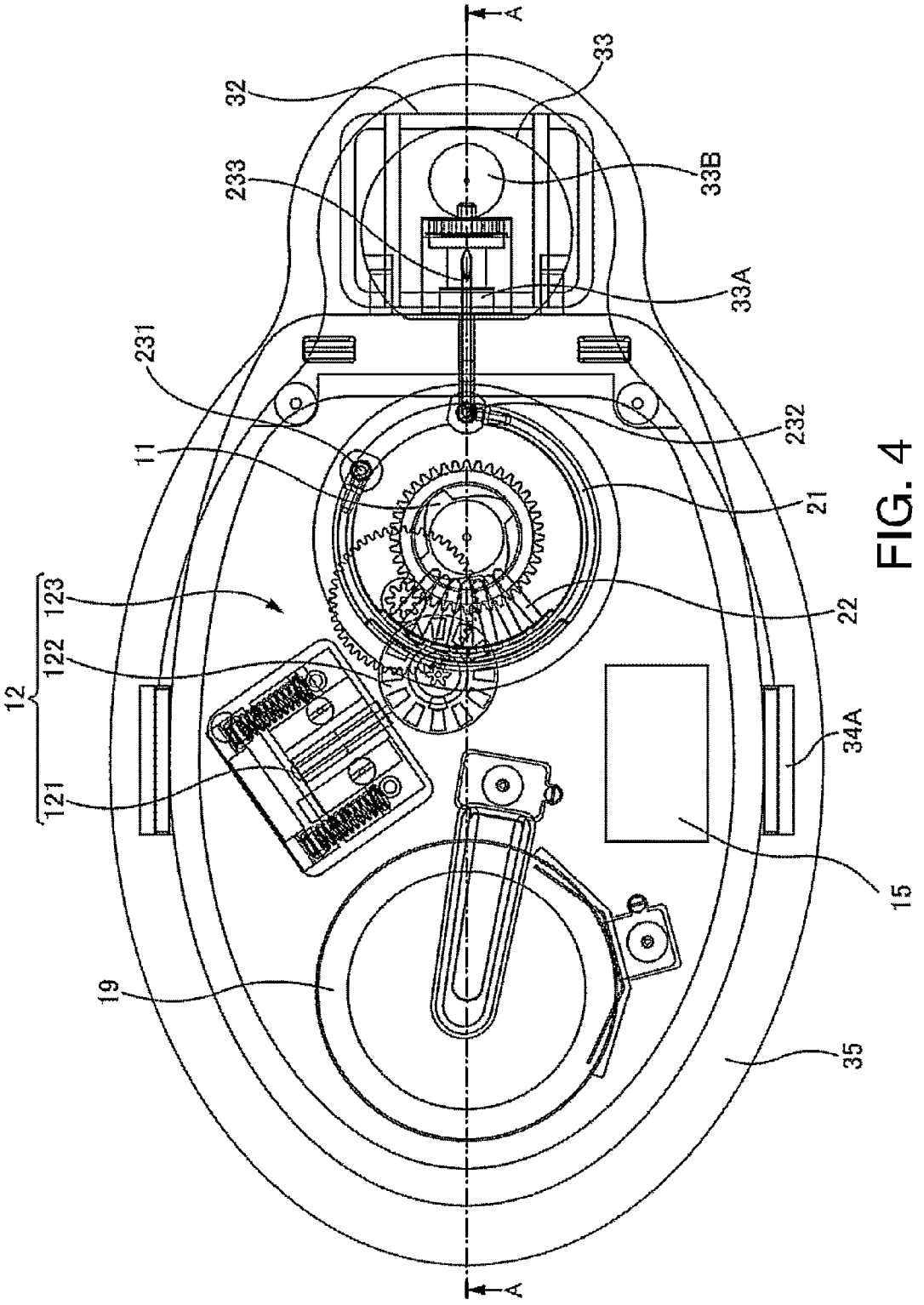


FIG. 4

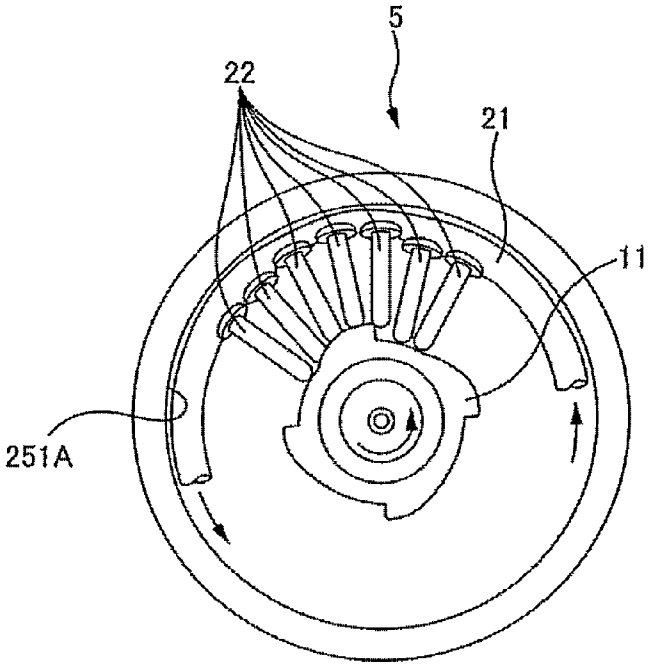


FIG. 5

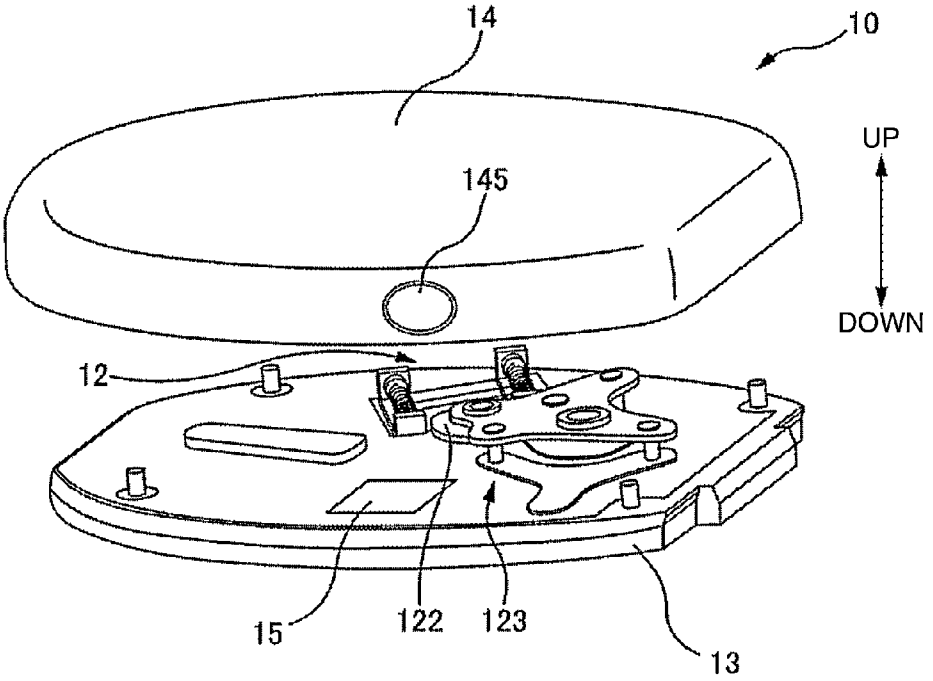


FIG. 6

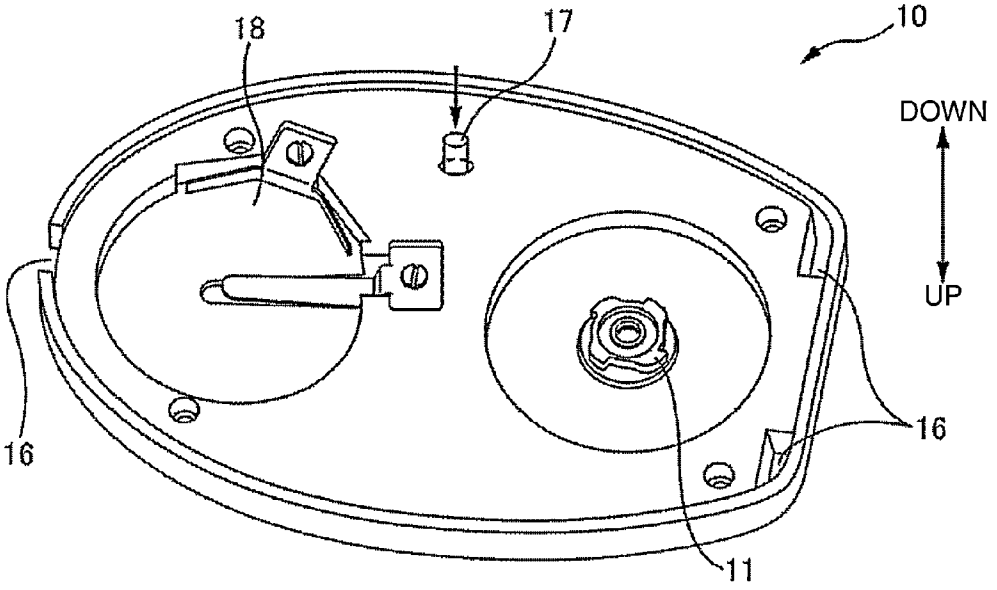


FIG. 7

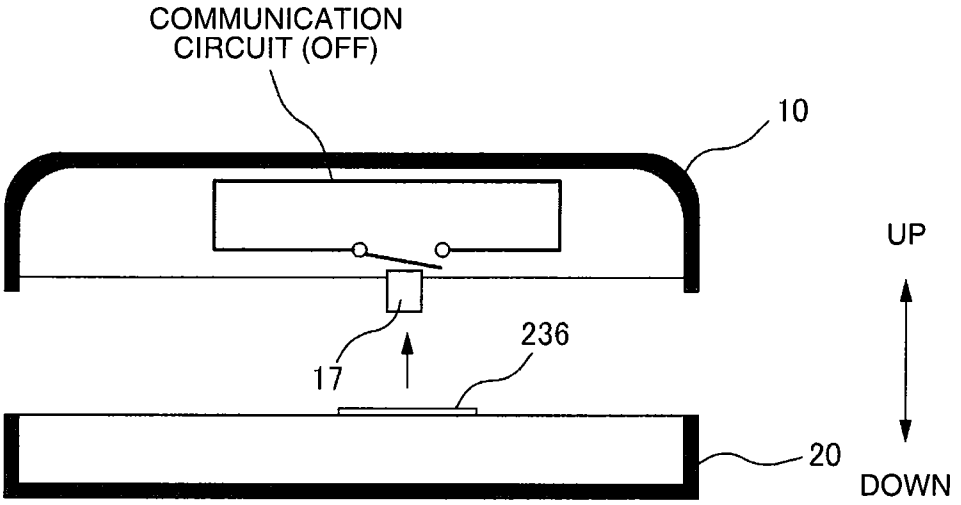

COMMUNICATION
CIRCUIT (OFF)
10
UP
236
17
20
DOWN

FIG. 8A

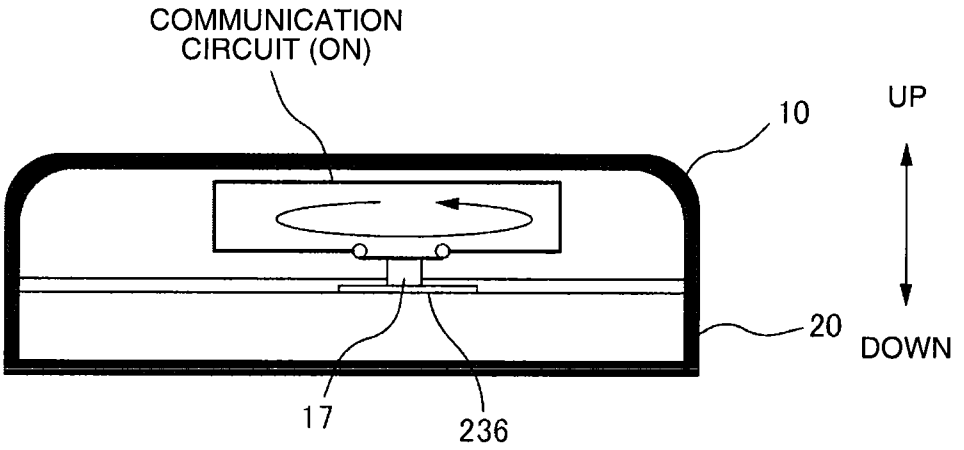

COMMUNICATION
CIRCUIT (ON)
10
UP
20
DOWN
17
236

FIG. 8B

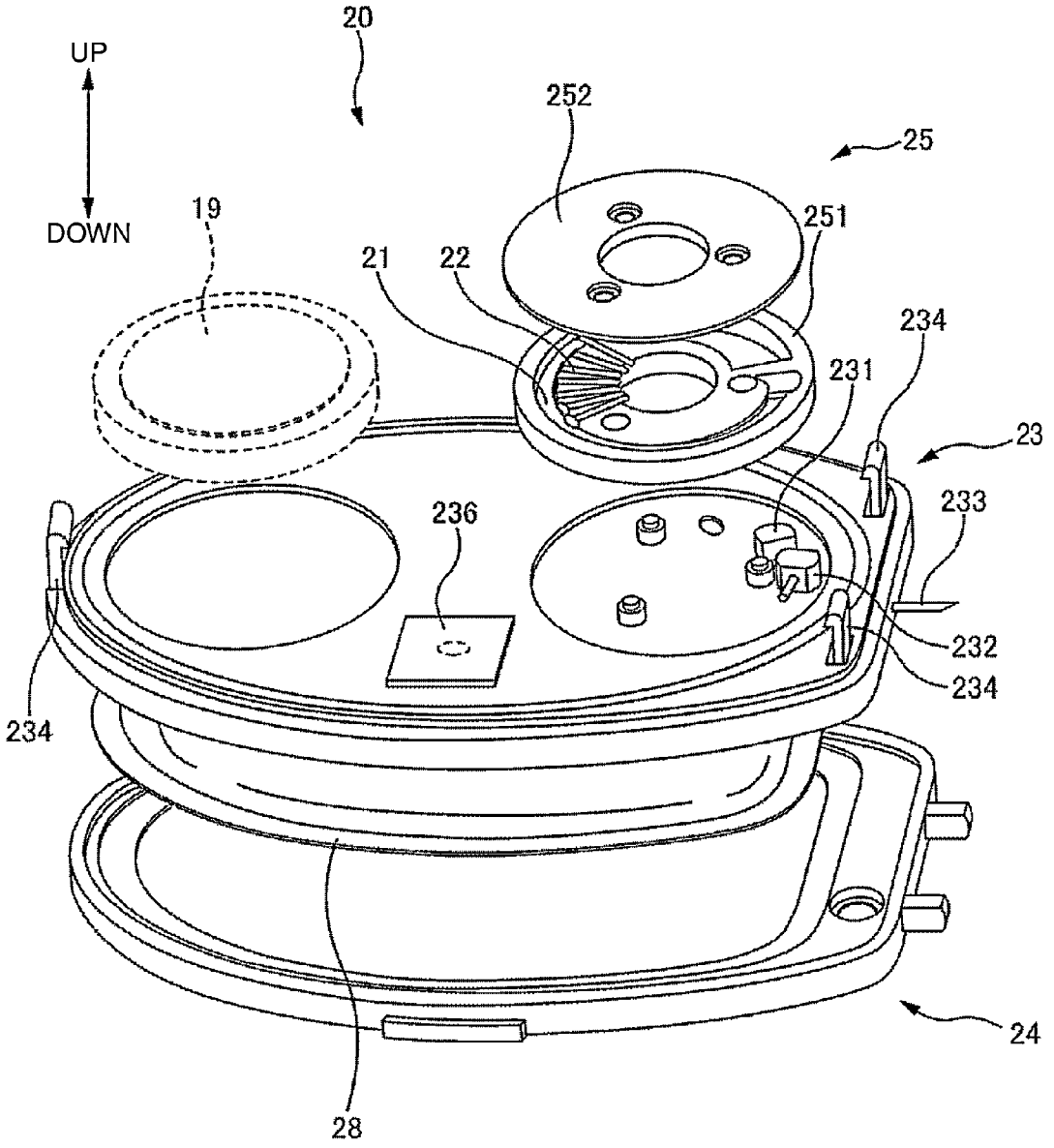


FIG. 9

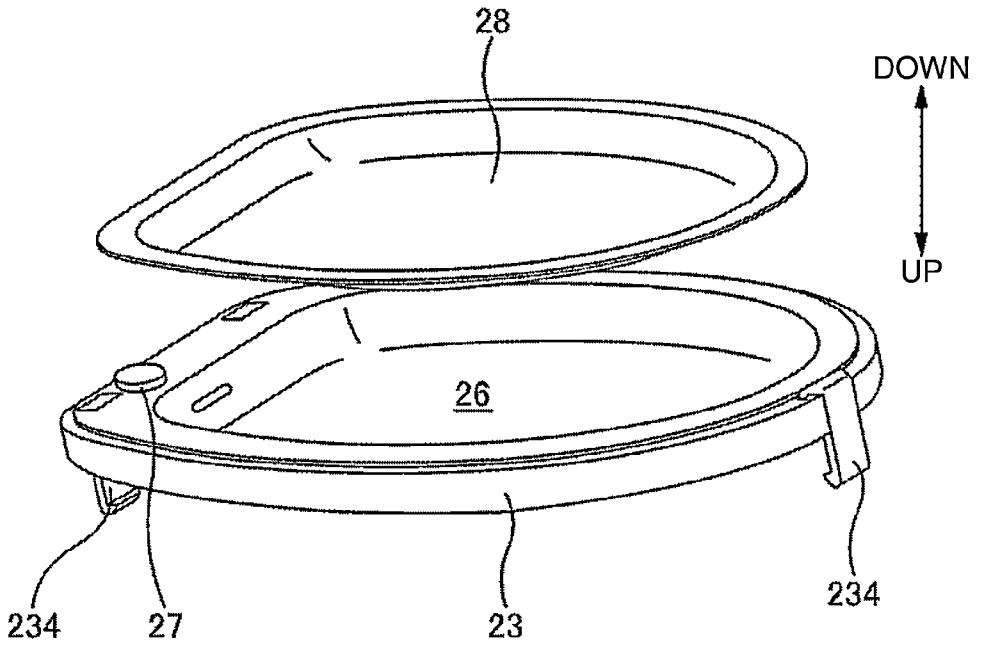


FIG. 10

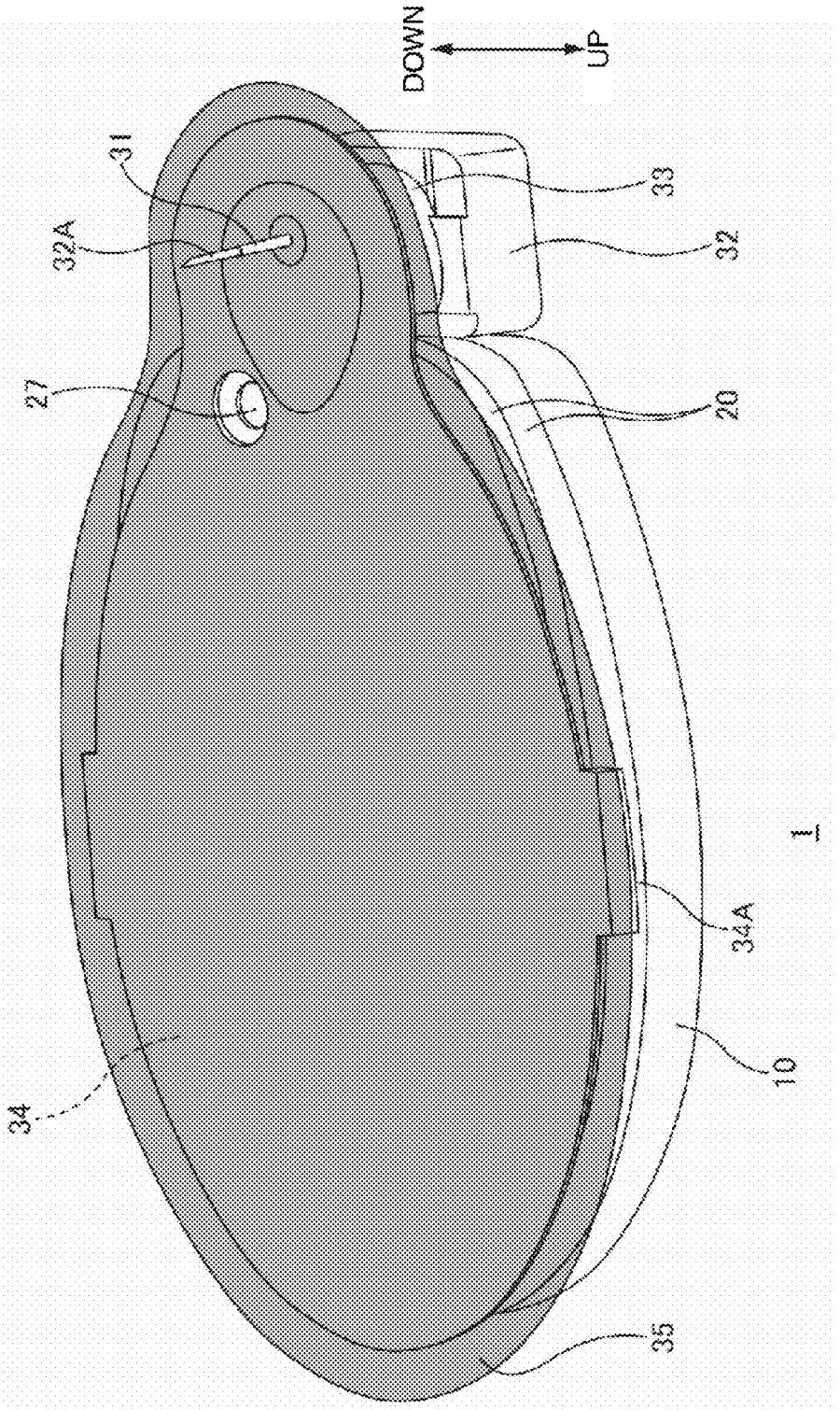


FIG. 11

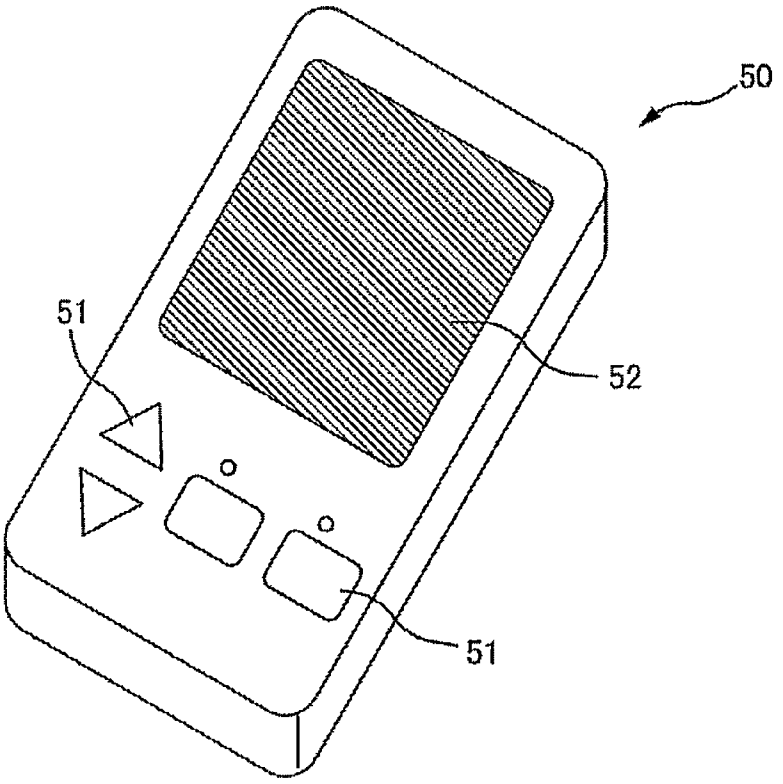


FIG. 12

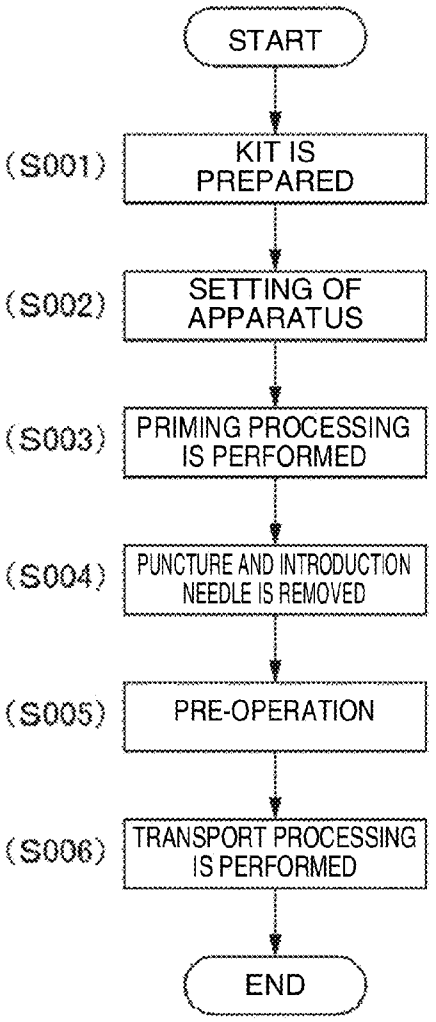

START
(S001)
KIT IS PREPARED
(S002)
SETTING OF APPARATUS
(S003)
PRIMING PROCESSING IS PERFORMED
(S004)
PUNCTURE AND INTRODUCTION NEEDLE IS REMOVED
(S005)
PRE-OPERATION
(S006)
TRANSPORT PROCESSING IS PERFORMED
END

FIG. 13

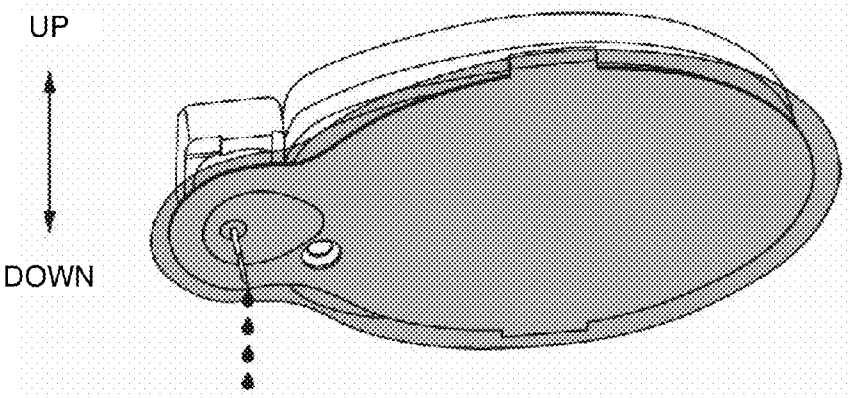

UP
DOWN

FIG. 14

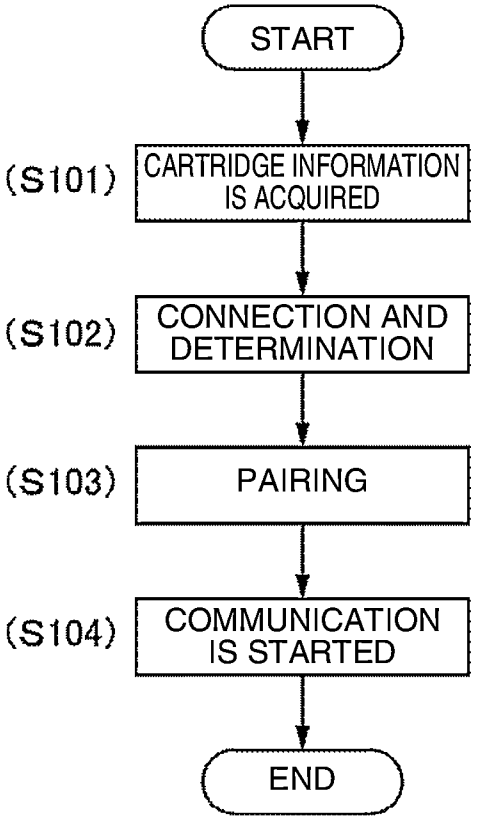

START
(S101)
CARTRIDGE INFORMATION IS ACQUIRED
(S102)
CONNECTION AND DETERMINATION
(S103)
PAIRING
(S104)
COMMUNICATION IS STARTED
END

FIG. 15

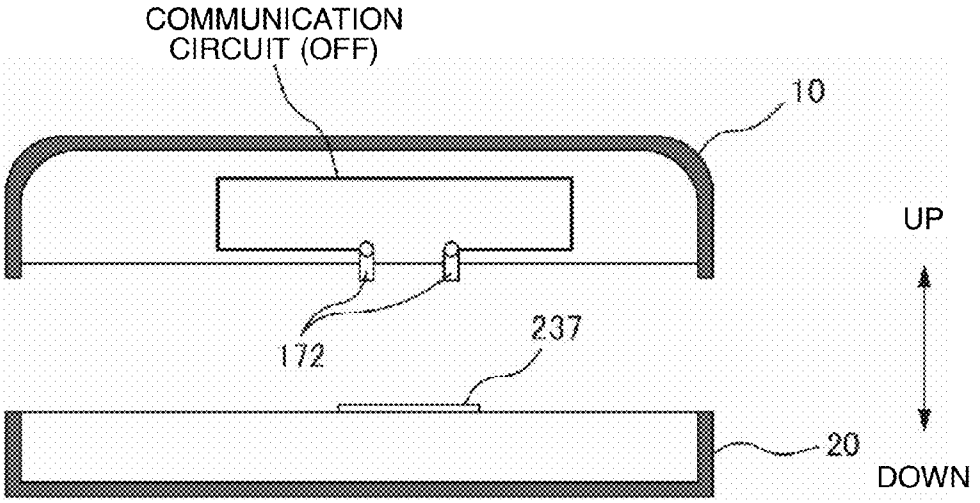


FIG. 16A

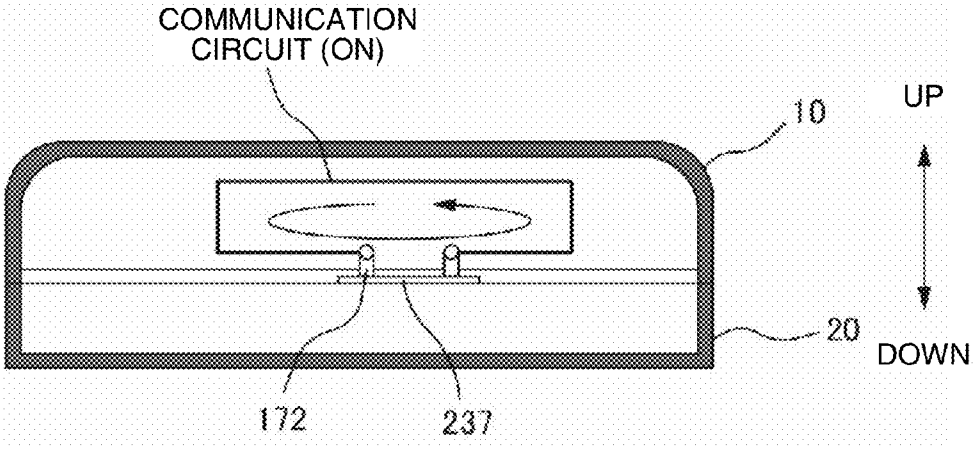


FIG. 16B

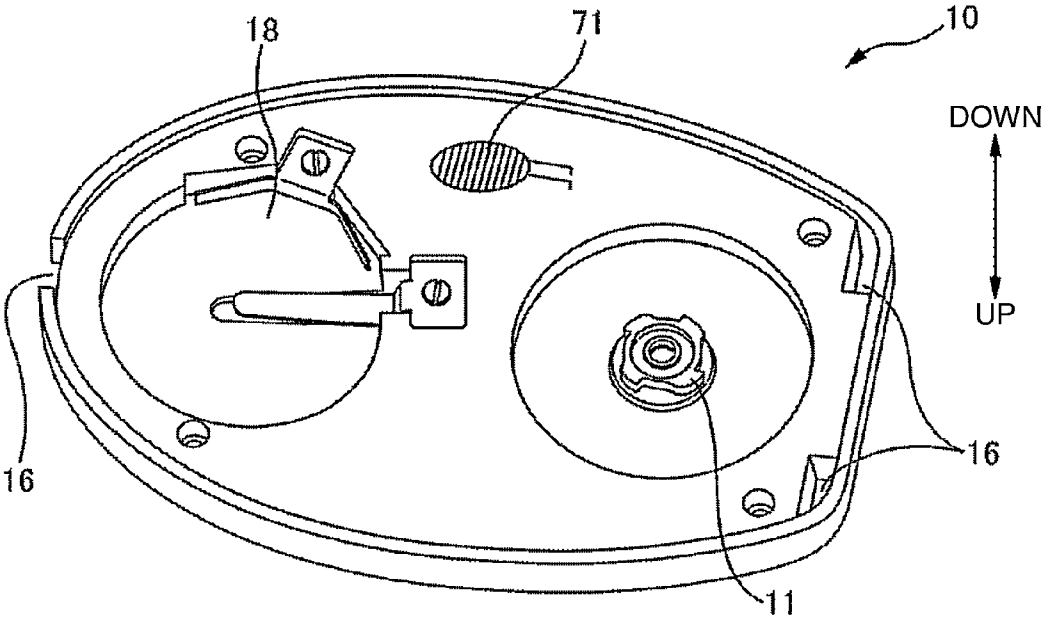


FIG. 17

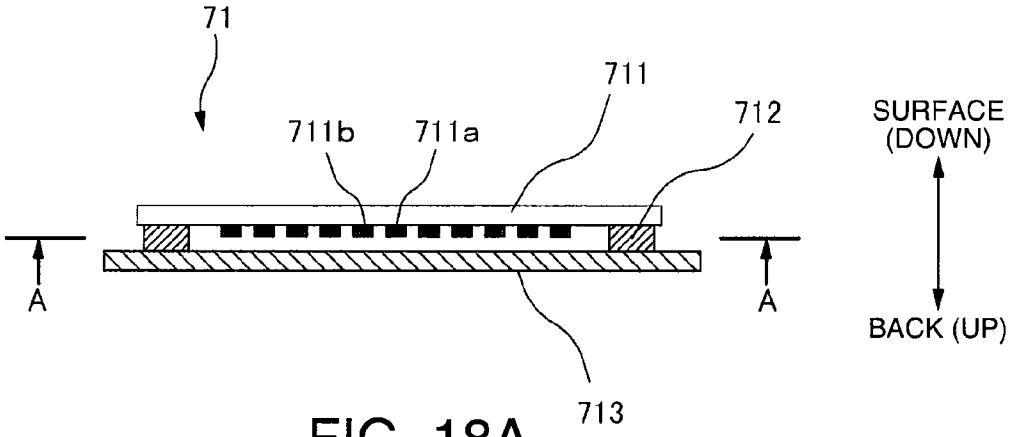
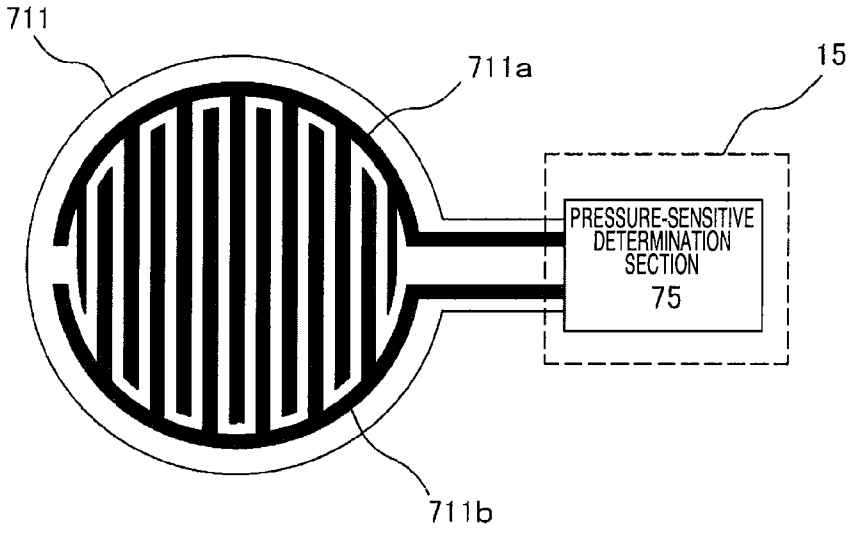


FIG. 18A



A-A CROSS SECTION

FIG. 18B

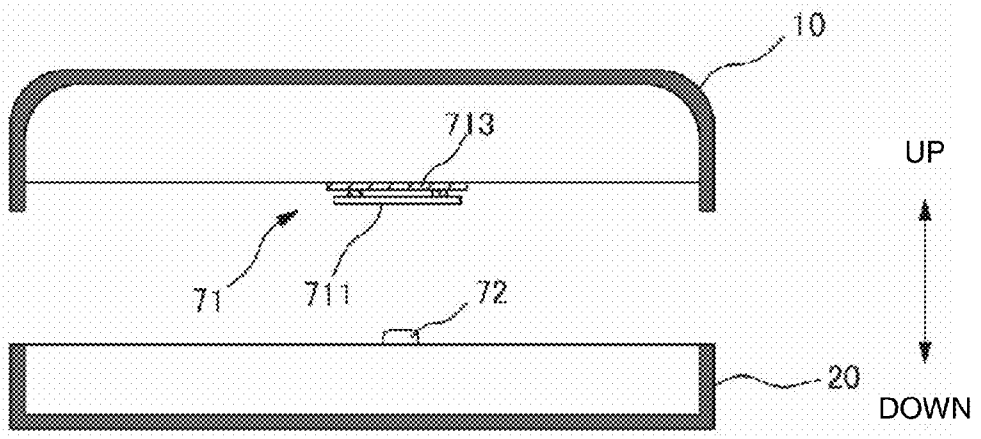


FIG. 19A

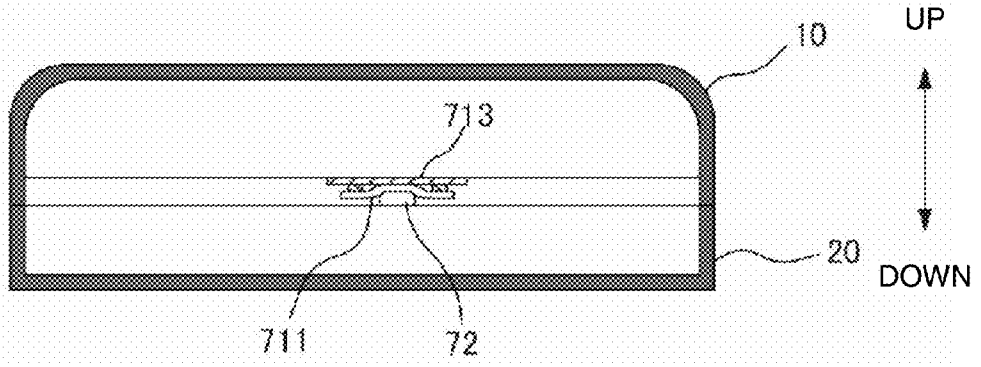


FIG. 19B

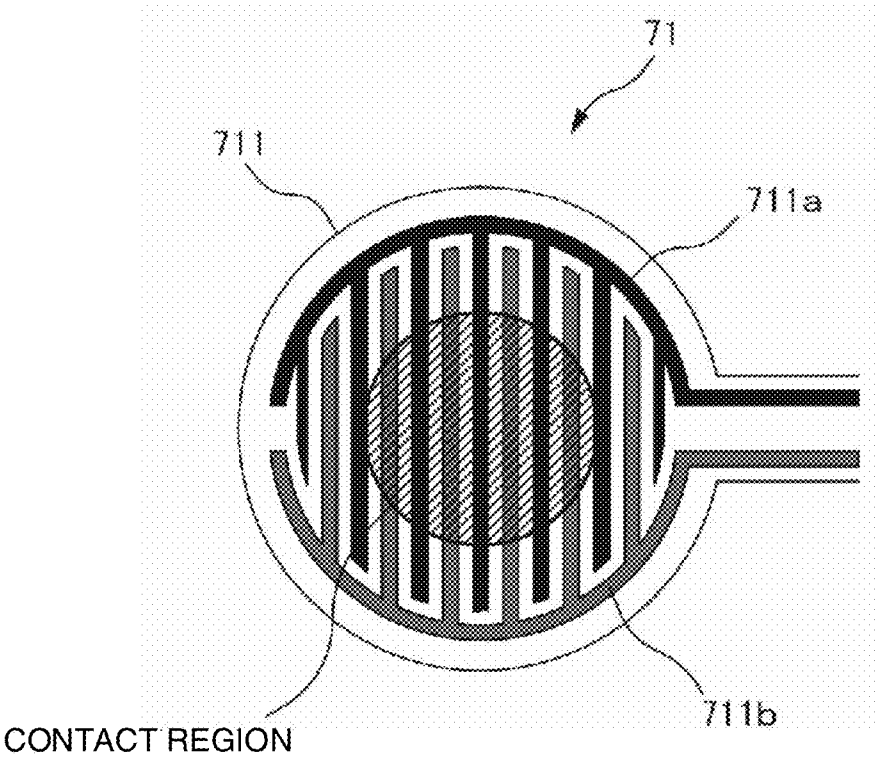


FIG. 20

LIQUID TRANSPORTING APPARATUS AND LIQUID TRANSPORTING METHOD

BACKGROUND

[0001] 1. Technical Field

[0002] The present invention relates to a liquid transporting apparatus and a liquid transporting method.

[0003] 2. Related Art

[0004] There is a liquid transporting apparatus capable of continuously transporting a liquid. As a practical example of the liquid transporting apparatus, an insulin injecting apparatus is known which is used when a liquid medicine such as insulin is subcutaneously injected. For example, an insulin dosing device that injects and transports the insulin using a liquid transporting apparatus into a living body through a catheter is disclosed in JP-T-2006-511263.

[0005] When controlling a liquid transportation operation by the liquid transporting apparatus, a remote operation is often performed using a controller. At this time, radio communication or the like is performed between a control section inside the liquid transporting apparatus and the controller and there is no need for the communication unless the liquid transportation operation is required. Regardless, the control section must be on standby so that the communication can be started any time and there is a likelihood of problem that power consumption occurs even during standby.

SUMMARY

[0006] An advantage of some aspects of the invention is to suppress power consumption during standby in a liquid transporting apparatus of which an operation is controlled by communication using a controller.

[0007] A liquid transporting apparatus according to an aspect of the invention includes: a liquid storage section that stores a liquid; a body section that supports a driving section having at least a part of function for transporting the liquid and is connected to the liquid storage section when transporting the liquid; a body control section that controls an operation of the driving section and determines whether the body section and the liquid storage section are connected; and an external control section that communicates with the body control section and performs instruction to control an operation of the driving section. If it is determined that the body section and the liquid storage section are connected, communication between the body control section and the external control section is started.

[0008] Other features of the invention will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

[0010] FIG. **1** is an overall perspective view of a liquid transporting apparatus.

[0011] FIG. **2** is an exploded view of the liquid transporting apparatus.

[0012] FIG. **3** is a cross-sectional view of the liquid transporting apparatus.

[0013] FIG. **4** is a transparent top view of an inside of the liquid transporting apparatus.

[0014] FIG. **5** is a schematic explanatory view of a driving section.

[0015] FIG. **6** is an exploded perspective view illustrating an internal structure of a body.

[0016] FIG. **7** is a perspective view of a back surface of the body.

[0017] FIGS. **8**A and **8**B are schematic views describing ON/OFF of a switch in a first embodiment.

[0018] FIG. **9** is an exploded perspective view illustrating an internal structure of a cartridge.

[0019] FIG. **10** is an exploded perspective view of a back surface of a base of the cartridge.

[0020] FIG. **11** is a perspective view in which the liquid transporting apparatus is viewed from a side of a bottom surface of an injection set.

[0021] FIG. **12** is a schematic view illustrating an example of a controller.

[0022] FIG. **13** is a flowchart illustrating a using method of the liquid transporting apparatus.

[0023] FIG. **14** is an explanatory view of a priming processing.

[0024] FIG. **15** is a view illustrating a flow when setting of communication is performed.

[0025] FIGS. **16**A and **16**B are schematic views describing ON/OFF of a communication circuit in a modification example of the first embodiment.

[0026] FIG. **17** is a perspective view of a back surface of a body in a second embodiment.

[0027] FIGS. **18**A and **18**B are views describing a structure of a pressure sensitive sensor.

[0028] FIGS. **19**A and **19**B are views describing a connection detection method using the pressure sensitive sensor.

[0029] FIG. **20** is a view describing a state of an electrode when measuring a pressure by the pressure sensitive sensor.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0030] At least matters below will become clear by the description of the specification and the accompanying drawings.

[0031] A liquid transporting apparatus includes: a liquid storage section that stores a liquid; a body section that supports a driving section having at least a part of function for transporting the liquid and is connected to the liquid storage section when transporting the liquid; a body control section that controls an operation of the driving section and determines whether the body section and the liquid storage section are connected; and an external control section that communicates with the body control section and performs instruction to control an operation of the driving section. If it is determined that the body section and the liquid storage section are connected, communication between the body control section and the external control section is started.

[0032] According to the liquid transporting apparatus with this configuration, it is possible to suppress power consumption during standby if the operation is controlled by the communication using the external controller.

[0033] Further, in the liquid transporting apparatus, it is preferable that the body section includes a communication circuit that performs communication with the external control section, the communication circuit has a contact point that is in a closed state by coming into contact with a contact section that is provided in the liquid storage section, and the body control section determines that the body section and the liquid storage section are connected if the contact point is in the closed state.

[0034] According to the liquid transporting apparatus with this configuration, at first, since there is no communication between the body section and the external control section during standby, the power consumption is small. Then, if it is determined that the liquid storage section and the body section are connected from a conduction state of the communication circuit, the body section and the external control section are in a state in which communication is possible. That is, since the communication between the body section and the external control section starts immediately before the liquid transporting operation is executed, it is possible to suppress the wasteful standby power consumption.

[0035] Further, in the liquid transporting apparatus, it is preferable that a pressure detection section that measures the pressure is provided in the body section, and the body control section measures an amount of pressure when the pressure detection section is pressed by a pressing section that is provided in the liquid storage section, and determines that the body section and the liquid storage section are connected if the pressure that is measured has a predetermined amount or more.

[0036] According to the liquid transporting apparatus with this configuration, at first, since there is no communication between the body section and the external control section, the power consumption is small in the state of the communication standby. Then, if it is determined that the body section and the liquid storage section are connected from a result of measurement of the pressure when the body section and the liquid storage section are connected, the body section and the external control section are in a state of being capable of communicating. That is, since the communication between the body section and the external control section starts immediately before the liquid transporting operation is executed, it is possible to suppress the wasteful standby power consumption.

[0037] Further, in the liquid transporting apparatus, it is preferable that information including a type and a storage amount of the liquid which is stored in the liquid storage section is recorded in the liquid storage section, and the information is acquired by the external control section.

[0038] According to the liquid transporting apparatus with this configuration, if the liquid is a medicine, it is possible to safely manage quality and dose of the medicine, based on the information.

[0039] Further, in the liquid transporting apparatus, it is preferable that the communication between the external control section and the body control section is performed using radio, and the setting of connection is performed between the external control section and the body control section before the communication is started.

[0040] According to the liquid transporting apparatus with this configuration, the body control section is suppressed from being erroneously connected to other external control sections and it is possible to perform safely communication between the body control section and the external control section.

[0041] Further, it will become clear that a liquid transporting method includes: determining whether a liquid storage section that stores a liquid and a body section that supports a driving section having at least a part of function for transporting the liquid and is connected to the liquid storage section when the liquid is transported are in a state of being connected; starting the communication to the external control section if it is determined that the body section and the liquid storage section are connected; and transporting the liquid by an instruction from the external control section.

First Embodiment

Basic Configuration of Liquid Transporting Apparatus

[0042] FIG. **1** is an overall perspective view of a liquid transporting apparatus **1**. FIG. **2** is an exploded view of the liquid transporting apparatus **1**. As illustrated in the views, description is given in which a side (a side of a living body) where the liquid transporting apparatus **1** adhere is referred to as "down" and the side opposite the living body is referred to as "up."

[0043] The liquid transporting apparatus **1** is an apparatus for transporting a liquid. The liquid transporting apparatus **1** includes a body **10**, a cartridge **20** and an injection set **30**. Further, a controller **50** (see FIG. **12**) for remotely controlling the liquid transporting apparatus **1** from outside is provided.

[0044] As illustrated in FIG. **2**, the body **10**, the cartridge **20** and the injection set **30** can be separated from each other, but as illustrated in FIG. **1**, they are integrally assembled when being used. The liquid transporting apparatus **1** is appropriately used to periodically inject liquid (for example, insulin) stored in the cartridge **20** with the injection set **30** adhering to the living body. If the liquid (for example, the insulin) stored in the cartridge **20** runs out, the cartridge **20** is replaced. Further, the injection set **30** is generally replaced at once in every three day. Meanwhile, the body **10** may be continuously used.

[0045] FIG. **3** is a cross-sectional view of the liquid transporting apparatus **1**. FIG. **4** is a transparent top view of an inside of the liquid transporting apparatus **1**. In FIG. **4**, a configuration of a driving section **5** is also illustrated. FIG. **5** is a schematic explanatory view of the driving section **5**.

[0046] The driving section **5** has a function as a pump for transporting the liquid stored in the cartridge **20**. The driving section **5** of the embodiment includes a cam **11** and a driving mechanism **12**, and transports the liquid by sequentially squeezing a tube **21** by driving a plurality of fingers **22**.

[0047] The tube **21** is a liquid transporting tube for transporting the liquid. An upstream side (an upstream side based on a transportation direction of the liquid) of the tube **21** communicates with a storage section **26** of the liquid of the cartridge **20**. The tube **21** has elasticity enough to be closed when being pressed by the finger **22** and to be returned to the original shape when releasing a force from the finger **22**. The tube **21** is partially disposed in a circular arc shape along an inner surface of a tube guide wall **251**A of the cartridge **20**. The portion of the tube **21** in the circular arc shape is disposed between the inner surface of the tube guide wall **251**A and the plurality of fingers **22**. A center of a circle arc of the tube **21** is coincident with a rotation center of the cam **11**.

[0048] The finger **22** is a member for closing the tube **21**. The finger **22** is operated in a driven basis by receiving a force from the cam **11**. The finger **22** has a rod-shaped shaft section and a collar-shaped pressing section, and is in a T-shape. The rod-shaped shaft section comes into contact with the cam **11** and the collar-shaped pressing section comes into contact with the tube **21**. The finger **22** is supported so as to be movable along an axial direction.

[0049] The plurality of fingers **22** are radially disposed at an equal interval from the rotation center of the cam **11**. The

plurality of fingers **22** are disposed between the cam **11** and the tube **21**. Here, seven fingers **22** are provided.

[0050] The cam **11** has protrusion sections at four positions of an outer periphery thereof. The plurality of fingers **22** are disposed on the outer periphery of the cam **11** and the tube **21** is disposed outside the fingers **22**. The tube **21** is closed when pressing the fingers **22** by the protrusion sections of the cam **11**. If the finger **22** is disengaged from the protrusion section, the tube **21** returns to the original shape by an elastic force of the tube **21**. If the cam **11** rotates, seven fingers **22** are pressed in order from the protrusion section and then the tube **21** closes in order from the upstream side in the transportation direction. Therefore, the tube **21** performs writhing and the liquid is squeezed and transported by the tube **21**. In order to prevent backflow of the liquid, the protrusion sections of the cam **11** are formed so that at least one and preferably two fingers **22** close the tube **21**.

[0051] The driving mechanism **12** is a mechanism for driving the cam **11** to rotate. The driving mechanism **12** has a piezoelectric motor **121**, a rotor **122** and a reduction transmission device **123** (see FIG. **4**).

[0052] The piezoelectric motor **121** is a motor for rotating the rotor **122** by using vibration of a piezoelectric element. The piezoelectric motor **121** vibrates a vibration body by applying a drive signal to the piezoelectric element that adheres to both surfaces of a rectangular vibration body. An end section of the vibration body comes into contact with the rotor **122** and the end section vibrates while drawing a predetermined orbit such as an elliptic orbit or an 8-shaped orbit, if the vibration body vibrates. The end section of the vibration body comes into contact with the rotor **122** in a part of the vibration orbit and then the rotor **122** is driven to rotate. The piezoelectric motor **121** is biased toward the rotor **122** by a pair of springs so that the end section of the vibration body comes into contact with the rotor **122**.

[0053] The rotor **122** is a driven body that is rotated by the piezoelectric motor **121**. A rotor pinion that configures a part of the reduction transmission device **123** is formed in the rotor **122**.

[0054] The reduction transmission device **123** is a device that transmits the rotation of the rotor **122** to the cam **11** with a predetermined reduction ratio. The reduction transmission device **123** is configured of a rotor pinion, a transmission wheel and a cam gear. The rotor pinion is a small gear which is integrally attached to the rotor **122**. The transmission wheel has a large gear that meshes with the rotor pinion and a pinion that meshes with the cam gear, and has a function for transmitting a rotational force of the rotor **122** to the cam **11**. The cam gear is integrally attached to the cam **11** and is rotatably supported with the cam **11**.

[0055] Hereinafter, configurations of the body **10**, the cartridge **20**, the injection set **30** and the controller **50** are described.

Body **10**

[0056] FIG. **6** is an exploded perspective view illustrating a configuration of an inside of the body **10**. FIG. **7** is a perspective view of aback surface of the body **10**. Hereinafter, the configuration of the body **10** is described with reference to FIGS. **1** to **4** and the drawings.

[0057] The body **10** has a body base **13** and a body case **14**. Then, the driving mechanism **12** described above and a control substrate **15** are maintained on the body base **13**. Further, a bearing **13**A is provided in the body base **13**. A rotation shaft of the cam **11** passes through the body base **13** and the bearing **13**A rotatably supports the rotation shaft of the cam **11** with respect to the body base **13**. The cam **11** is integrally formed with the cam gear configuring the reduction transmission device **123** and the cam gear is disposed inside the body **10** by being covered by the body case **14**, and the cam **11** is exposed from the body **10**. If the body **10** and the cartridge **20** are combined together, the cam **11** which is exposed from the body **10** meshes with the end section of the finger **22** of the cartridge **20**.

[0058] The body case **14** is a member configuring an exterior of the liquid transporting apparatus **1**. The driving mechanism **12** (the piezoelectric motor **121**, the rotor **122** and the reduction transmission device **123**) or the control substrate **15** provided in the body base **13** is covered and protected by the body case **14**.

[0059] In the embodiment, a function button **145** is provided in the body case **14**. The function button **145** is a button which can set a plurality of functions and can realize any function which is set when the button is pressed. The function button **145** of the embodiment has functions which performs setting of the communication or functions which perform switching of a plurality of control patterns which are set in the control substrate **15** described below. Moreover, setting of the functions of the function button **145** is done using the controller **50**.

[0060] The control substrate **15** is a body control section that controls an operation of the driving section **5**. The body control section in the embodiment has functions which determines whether the body **10** and the cartridge **20** are correctly connected, and which starts the communication between the liquid transporting apparatus **1** (the body **10**) and the controller **50**. A storage section (a memory) storing a plurality of control patterns (control programs) for controlling the piezoelectric motor **121** or the like is provided in the control substrate **15**. Then, the cam **11** is driven, based on one of the plurality of control patterns stored in the storage section, and writhing of the tube **21** can be controlled by the finger **22**. Moreover, the control patterns are set by using the controller **50**.

[0061] In addition, the body **10** has a hook hanger **16**, a switch **17**, a battery storage section **18** and a receiving section (not illustrated). The hook hanger **16** is a member for fixing the cartridge **20** and the body **10** being connected. A fixed hook **234** of the cartridge **20** described below is caught on the hook hanger **16** and the body **10** is fixed to the cartridge **20**. The battery storage section **18** stores a battery **19** that is a power supply of the liquid transporting apparatus **1** (see FIG. **9**). The receiving section receives a signal or a radio wave that is transmitted from the controller **50** described below.

[0062] As illustrated in FIG. **7**, the switch **17** is a protrusion member that protrudes downward from a back surface (a lower surface side) of the body **10** (the body base **13**) and corresponds to a push-button switch turning ON/OFF of a communication circuit (not illustrated in FIG. **7**) incorporated inside the body base **13**. The switch **17** is movable so as to be pushed into the body base **13** (that is, in an upper direction of the body **10**). In a state where the switch **17** protrudes from the body base **13**, the communication circuit is in an open state (OFF state) and a current does not flowed. On the other hand, if the switch **17** is pushed into the body base **13**, the communication circuit is in a closed state (ON state) and the current flows, and then the communication circuit is capable of communicating with the controller **50**.

[0063] In the liquid transporting apparatus **1** of the embodiment, ON/OFF of the switch **17** is switched by connecting the body **10** and the cartridge **20**. FIGS. **8**A and **8**B are schematic views describing ON/OFF of the switch **17** in the first embodiment. In FIG. **8**A, when the body **10** and the cartridge **20** are not connected to each other, the switch **17** is in a state of protruding from the side of the lower surface of the body **10** and a contact point of the communication circuit provided inside the body **10** is open and then the circuit is in the OFF state. On the other hand, as illustrated in FIG. **8**B, when the body **10** and the cartridge **20** are connected, a leading end of a lower side of the switch **17** protruding from the lower surface side of the body **10** comes into contact with a contact plate **236** (see FIG. **9**) provided on the side of the upper surface of the cartridge **20** and then the contact plate **236** pushes the switch **17** in the upper direction. Therefore, the leading end of the upper side of the switch **17** causes the contact point of the communication circuit provided inside the body **10** to be closed and the circuit is in the ON state. That is, in the embodiment, the switch **17** functions as a so-called mechanical contact point. Moreover, if the cartridge **20** is detached from the body **10**, the switch **17** returns to an initial state (a state of FIG. **8**A) and the communication circuit is turned to OFF again. A communication method with the controller **50** after the communication circuit is turned to ON is described below.

Cartridge **20**

[0064] FIG. **9** is an exploded perspective view illustrating a configuration of an inside of the cartridge **20**. FIG. **10** is an exploded perspective view of aback surface of the cartridge **20**. Hereinafter, a configuration of the cartridge **20** is described with reference to FIGS. **1** to **5** and the drawings.

[0065] The cartridge **20** has a cartridge base **23** and a base receiver **24**.

[0066] A tube unit **25** is provided on an upper side of the cartridge base **23**. The tube unit **25** has the tube **21** and the plurality of fingers **22** which are described above, a unit base **251** and a unit cover **252**. The tube guide wall **251**A is formed in the unit base **251** and the tube **21** is disposed inside the unit base **251** in a circular arc shape. Further, the unit base **251** movably supports the fingers **22** in the axial direction. The tube **21** and the fingers **22** inside the unit base **251** are covered by the unit cover **252**.

[0067] The tube unit **25** is in a planar cylindrical shape and the cam **11** exposed from the body **10** is inserted into a cavity of a center of the tube unit **25**. Therefore, the cam **11** on the side of the body **10** meshes with the fingers **22** on the side of the cartridge **20**.

[0068] A supply-side joint **231** and a discharge-side joint **232** are provided in the cartridge base **23**. End sections of the tube **21** inside the tube unit **25** are connected to the supply-side joint **231** and the discharge-side joint **232**, respectively. If the plurality of fingers **22** squeeze the tube **21** in order, the liquid is supplied from the supply-side joint **231** to the tube **21** and the liquid is discharged from the discharge-side joint **232**. A connection needle **233** communicates with the discharge-side joint **232** and the liquid discharged from the discharge-side joint **232** is supplied to the side of the injection set **30** through the connection needle **233**.

[0069] The fixed hook **234** is formed in the cartridge base **23**. The fixed hook **234** is caught on the hook hanger **16** of the body **10** and fixes the body **10** to the cartridge **20**. The contact plate **236** that is a contact section coming into contact with the leading end section of the switch **17** when connecting with the body **10** is provided on the upper surface of the cartridge base **23**. The switch **17** is pressed to the upper side (the side of the body **10**) by coming into contact with the contact plate **236** (see FIGS. **8**A and **8**B).

[0070] A reservoir film **28** is interposed between the cartridge base **23** and the base receiver **24**. Circumference of the reservoir film **28** comes into close contact with a bottom surface of the cartridge base **23**. The storage section **26** is formed between the cartridge base **23** and the reservoir film **28**, and the liquid (for example, the insulin) is stored in the storage section **26**. The storage section **26** communicates with the supply-side joint **231** and the liquid stored in the storage section **26** is supplied to the tube **21** through the supply-side joint **231**.

[0071] As described above, the storage section **26** is configured on the lower side of the cartridge base **23**. Since the tube **21** and the fingers **22** configuring the driving section **5** are disposed on the upper side of the cartridge base **23**, the driving section **5** and the storage section **26** are disposed up and down. Therefore, miniaturization of the liquid transporting apparatus **1** is achieved. Further, the storage section **26** is disposed further to the side of the living body than the driving section **5**. Therefore, the liquid stored in the storage section **26** is likely to maintain the temperature thereof with the temperature of the living body and a difference between the temperature of the liquid and the temperature of the living body is suppressed.

[0072] If the liquid stored in the storage section **26** runs out, the cartridge **20** is detached from the liquid transporting apparatus **1** and is replaced with new cartridge **20**. However, the liquid can be injected from outside into the storage section **26** through a cartridge septum **27** using an injection needle. Moreover, the cartridge septum **27** is configured of a material (for example, rubber, silicon or the like) that closes a hole if the injection needle is pulled out.

Injection Set **30**

[0073] FIG. **11** is a perspective view of the liquid transporting apparatus **1** viewed from a side of the bottom surface of the injection set **30**. Hereinafter, a configuration of the injection set **30** is described with reference to FIGS. **1** to **5** and the drawing.

[0074] The injection set **30** has a soft needle **31**, an introduction needle folder **32**, a port base **33**, an injection set base **34** and an adhesive pad **35**.

[0075] The soft needle **31** is a tube for injecting the liquid into the living body and has a function of a catheter. For example, the soft needle **31** is configured of a soft material such as fluorine resin. An end of the soft needle **31** is fixed to the port base **33**.

[0076] The introduction needle folder **32** is a member for holding an introduction needle **32**A. An end of the introduction needle **32**A is fixed to the introduction needle folder **32**. The introduction needle **32**A is a needle made of a metal for inserting the soft needle **31** which is soft into the living body. The introduction needle **32**A is a hollow tubular needle which is long and narrow, and has a transverse hole (not illustrated). If the liquid is supplied from the transverse hole of the introduction needle **32**A, the liquid is discharged from a leading end of the introduction needle **32**A. Therefore, before the soft needle **31** punctures the living body, priming processing which fills the inside a flow path of the liquid transporting apparatus **1** with the liquid can be performed.

[0077] In a state prior to use, the introduction needle folder **32** is attached to the port base **33**, the introduction needle **32**A is inserted into the soft needle **31** and then a needle tip is exposed from the lower side of the soft needle **31**. When the injection set **30** is attached to the living body, after the soft needle **31** and the introduction needle **32**A puncture the living body, the introduction needle folder **32** is withdrawn (removed) from the port base **33** together with the introduction needle **32**A. Since the introduction needle **32**A which is hard does not need to be continuously placed in the living body, a load on the living body is small. Moreover, although the soft needle **31** is continuously placed on the living body, the soft needle **31** is soft, and thus, the load on the living body is small.

[0078] The port base **33** is a member that supplies the liquid supplied from the connection needle **233** of the cartridge **20** to the soft needle **31**. The port base **33** has a connection needle septum **33**A and an introduction needle septum **33**B. The connection needle septum **33**A and the introduction needle septum **33**B are configured of a material (for example, rubber, silicon or the like) that closes the hole if the needle is pulled out. The connection needle **233** of the cartridge **20** is inserted into the connection needle septum **33**A and the liquid is supplied from the side of the cartridge **20** to the side of the injection set **30** through the connection needle **233** over the connection needle septum **33**A. Even if the connection needle **233** of the cartridge **20** is pulled out from the injection set **30** to replace the cartridge **20**, the hole of the connection needle septum **33**A that is generated by the connection needle **233** is closed naturally. The introduction needle **32**A is inserted into the introduction needle septum **33**B and if the introduction needle **32**A is pulled out, the hole of the introduction needle septum **33**B that is generated by the introduction needle **32**A is closed naturally. The liquid inside the injection set **30** is prevented from leaking to the outside or a body liquid of the living body is prevented from flowing back to the side of the injection set **30** by the connection needle septum **33**A and the introduction needle septum **33**B. Moreover, a region (a region except the introduction septum) in which the introduction needle **32**A is present inside the port base **33** is a flow path of the liquid after the introduction needle **32**A is pulled out.

[0079] The injection set base **34** is a planar member fixed to the port base **33**. The injection set base **34** has a fixing section **34**A for fixing the base receiver **24**. The adhesive pad **35** is attached to the bottom surface of the injection set base **34**. The adhesive pad **35** is an adhesive pad for bonding the injection set **30** to the living body or the like.

[0080] In the liquid transporting apparatus **1**, the driving section **5** and the storage section **26** are vertically disposed and reduction of the size of the liquid transporting apparatus **1** is achieved. Therefore, it is possible to reduce the size of the adhesive pad **35**.

Controller **50**

[0081] FIG. **12** is a schematic view illustrating an example of the controller **50**. The controller **50** is an external control section that makes the liquid transporting apparatus **1** perform the liquid transportation operation or sets the functions and, for example, is capable of remotely operating the liquid transporting apparatus **1** using wireless communication such as "Bluetooth" (registered trademark) or "ZigBee" (registered trademark), or infrared beams. The controller **50** has operation buttons **51** and a display section **52**, a reading section and a storage section (both not illustrated).

[0082] The user can start/stop the liquid transportation operation or set the control patterns (programs) defining the liquid transport amount per unit time or the like by operating the operation buttons **51**. Further, the operation buttons **51** are also used in start or setting of the communication with the body **10**. Information (for example, information indicating the liquid transport amount) regarding the liquid transportation operation is displayed on the display section **52** and the user can perform various types of setting while recognizing the information which is displayed. A present time, an alarm concerning the liquid transportation operation or the like is also displayed on the display section **52**.

[0083] Moreover, in the embodiment, it is possible to use commercially available smartphone as the controller **50**. In this case, when performing the communication for controlling the liquid transporting apparatus **1**, occurrence of malfunction or the like is suppressed by pairing (described below) with the body **10**.

Using Method of Liquid Transporting Apparatus

[0084] FIG. **13** is a flowchart illustrating a using method of the liquid transporting apparatus **1**.

[0085] First, the user prepares a kit of the liquid transporting apparatus **1** (S**001**). The body **10**, the cartridge **20**, the injection set **30** or the like for configuring the liquid transporting apparatus **1** is included in the kit. As illustrated in FIG. **2**, the user assembles the liquid transporting apparatus **1** by assembling the body **10**, the cartridge **20** and the injection set **30**, and then performs setting of starting for the liquid transportation operation (S**002**). The user makes the cam **11** on the side of the body **10** mesh with the finger **22** on the side of the cartridge **20** by assembling the body **10** and the cartridge **20**. At this time, as described above, the communication circuit is turned to ON state and is in a state of being capable of communicating with the controller **50** according to the body **10** and the cartridge **20** being connected to each other. Further, the user inserts the connection needle **233** of the cartridge **20** into the connection needle septum **33**A of the injection set **30** and makes the liquid be capable of being supplied from the side of the cartridge **20** to the side of the injection set **30**.

[0086] Next, the user performs the priming processing (S**003**). FIG. **14** is an explanatory view of the priming processing. The priming processing is a processing that fills the inside the flow path of the liquid transporting apparatus **1** with the liquid by driving the driving section **5** of the liquid transporting apparatus **1**. Gas inside the flow path of the liquid transporting apparatus **1** is discharged from the introduction needle **32**A by the priming processing. Further, the tube **21** which is vacant is filled with the liquid by the priming processing. The user drives the driving section **5** of the liquid transporting apparatus **1** until the liquid is discharged from the leading end of the introduction needle **32**A.

[0087] After the priming processing, the user makes the introduction needle **32**A and the soft needle **31** puncture perpendicularly the living body, after that, withdraws the introduction needle folder **32** from the port base **33**, and removes the introduction needle **32**A from the soft needle **31** (S**004**). Since there is the introduction needle septum **33**B, even if the introduction needle **32**A is removed, the hole of the introduction needle septum **33**B that is generated by the introduction needle **32**A is closed naturally. At this time, the user peels a protective sheet of the adhesive pad **35** of the injection

set **30** and the liquid transporting apparatus **1** may adhere to the living body by attaching the adhesive pad **35** to the skin of the living body.

[0088] Next, the user performs pre-operation of the driving section **5** so that the liquid for a capacity of a region (a region except the introduction septum) in which the introduction needle **32**A is present is transported (S**005**). Therefore, it is possible to fill a space with the liquid at which the introduction needle **32**A is present.

[0089] After that, the user makes the liquid transporting apparatus **1** perform a liquid transport processing (S**006**). In the liquid transporting apparatus **1**, the cam **11** is rotated by driving the piezoelectric motor **121** of the driving mechanism **12**, seven fingers **22** are pressed in order by the protrusion sections of the cam **11** and the tube **21** is closed in order from the upstream side in the transportation direction, and then the liquid is transported by writhing of the tube **21**. In a quantitative transport processing, the rotation amount of the cam **11** is controlled so that the liquid of a predetermined amount is transported in a predetermined time.

Setting of Communication

[0090] Setting of the communication among settings which are performed in S**002** of FIG. **13** is described. The operation of the liquid transporting apparatus **1** is controlled by communicating with the controller **50**. However, if a state where the communication is possible is maintained for all times, the power consumption on the communication standby is increased and there is a concern that an important liquid transportation operation may be interrupted, the liquid transporting apparatus **1** is in a state of being capable of communicating at a necessary timing by performing the setting of the communication at an appropriate time before the liquid transportation operation is practically performed. Therefore, wasteful standby power consumption is suppressed. Further, since it is assumed that the liquid transporting apparatus **1** is also used as the insulin injection device, high accuracy of the liquid transportation operation is required. Therefore, in order to suppress occurrence of a malfunction, the setting of the communication with the controller **50** is important.

[0091] FIG. **15** is a view illustrating a flow when the setting of the communication is performed.

[0092] First, specific information of the cartridge **20** used in the liquid transportation operation is obtained by using the controller **50** (S**101**). The specific information of the cartridge **20** is a type and a storage amount of a liquid that is stored in the storage section **26** of the cartridge **20**, a manufacturing number of the cartridge and the like. The information is stored as a bar code or a two-dimension code (for example, "QR code" (registered trademark)) associated with an ID of the cartridge. The user obtains the specific information of the cartridge **20** by reading the two-dimension code or the like given to the cartridge **20** using the reading section of the controller **50**, and the specific information is temporarily stored in the storage section of the controller **50**. When using the liquid transporting apparatus **1** as the insulin injection device or the like, it is also possible to perform safety management of quality or dosage of the medicine, based on the information.

[0093] Further, pairing information for communication with one to one between the body **10** connected to the cartridge **20** and the controller **50** is also included in the specific information of the cartridge. Pairing is to perform setting of connection between two devices communicating using radio or the like. For example, if "Bluetooth" described above is used as means for communication, it is necessary to make the controller **50** and the body **10** be accessible to each other by the Bluetooth device. At this time, the setting of the connection of two devices is performed, based on the pairing information given to the cartridge **20**.

[0094] Further, information regarding a correction coefficient when the liquid transportation operation is performed is included in the specific information of the cartridge. The correction coefficient is a coefficient for correcting the liquid transport amount per unit time by the liquid transporting apparatus **1**. In the liquid transporting apparatus **1**, writhing of the tube **21** is performed by the plurality of fingers **22** thereby performing the transportation of the liquid. However, quality of the tube **21** is not necessarily uniform. For example, a slight difference occurs in a wall thickness (a thickness of a wall surface) or elasticity of the tube **21** when manufacturing the tube **21** and variation in quality may occur. If such variation occurs in the tube **21**, difference occurs in timing when the tube **21** that is squeezed returns to the original shape or in the writhing property and thus, an error may occur in the liquid transport amount of the cartridge **20**. Further, if the length of the finger **22** on the squeezing side of the tube **21** is not uniform, there is a concern that an error in the liquid transport amount may also occur. Then, change in the liquid transport amount when replacing the cartridge **20** is suppressed by setting the correction coefficient for the cartridge **20** individually. Moreover, the correction coefficient is determined when quality test or the like is performed in a manufacturing processing of the cartridge **20**.

[0095] After the controller **50** obtains the specific information of the cartridge **20**, connection between the cartridge **20** and the body **10** is performed and it is determined whether or not both are properly connected (S**102**). The connection of the cartridge **20** and the body **10** is performed as described in FIGS. **2** and **9**, and the switch **17** described above is turned to ON and the current flows on the communication circuit by connecting the both members. The control substrate **15** determines that the cartridge **20** and the body **10** are correctly connected when communication circuit is in a conduction state and if it is determined that the connection is achieved, the body **10** is in a state of being capable of communicating.

[0096] Next, the pairing of the body **10** (the cartridge **20**) and the controller **50** is performed (S**103**). When performing the pairing, first, the body **10** is in a state of being capable of pairing by continuously pressing (long press) the function button **145** provided in the body **10** in a predetermined time (for example, three seconds). The button is long pressed to prevent occurrence of malfunction in which the pairing is immediately started when the button is accidentally touched by mistake. However, the pairing may be started by other methods. Subsequently, after searching a communication target device (in this case, the body **10**) by operating the operation buttons **51** of the controller **50** and finding the body **10**, the pairing processing is performed. In the pairing processing, the setting of the connection of the body **10** connected to the cartridge **20**, and the controller **50** is performed, based on the pairing information obtained from the cartridge **20**, and the state of being capable of communicating is made between two devices by "the Bluetooth" or the like. Therefore, safe communication can be performed between the controller **50** and the body **10**.

[0097] Moreover, a personal identification number or a password may be input to the controller **50** during the pairing.

In the embodiment, the liquid transporting apparatus **1** is remote controlled using radio or the like by the controller **50**. At this time, there is a concern that if the body **10** is paired with a device other than the controller **50**, control system becomes confused and then the malfunction may occur. For example, in a case of the Bluetooth device, one device can be paired with a plurality of devices and there is a concern that two external control device may be connected to one body **10**. Then, such a erroneous connection is suppressed by requesting input of the personal identification number when performing the pairing. Further, if the liquid transporting apparatus **1** is used as the insulin injection device, since personal information such as the insulin injection amount is handled, it is preferable to ensure security by setting the personal identification number described above.

[0098] After performing the pairing, practical communication starts (S**104**). In the embodiment, the liquid transportation operation may be started by the liquid transporting apparatus **1** using the controller **50** and it is possible to change the liquid transport amount. For example, if the liquid transporting apparatus **1** is used as the insulin injection device, it is possible to continuously inject the insulin of a certain amount by normal liquid transportation operation (such an injecting method is referred to as "a basal"). Meanwhile, since a blood glucose level temporarily increases when the user takes a meal, it is necessary to increase the injection amount of the insulin according to the increase in the blood glucose level (such an injecting method is referred to as "a bolus"). Thus, in the liquid transporting apparatus **1**, it is possible to change the liquid transport amount by using the controller **50**. Adjustment of the transport amount is performed by controlling the operation of the driving section **5**, based on a predetermined control pattern among a plurality of control patterns stored in the control substrate **15**.

[0099] For example, if the normal insulin injection of the user is 1 U (1 unit=approximately 10 μliters) per hour, an injection speed of 1 U/h is set as the control pattern for the basal. Further, if it is necessary to inject the insulin of 20 U (20 units) in a short term when taking a meal, the injection amount of 20 U is set as the control pattern for the bolus. Then, the insulin injection is normally performed at the injection speed of 1 U/h, based on the control pattern for the basal. Meanwhile, the control pattern for the bolus is used and the insulin of 20 U is injected within 24 hours of taking a meal.

[0100] Moreover, the controller **50** is also used when storing the control pattern during the liquid transportation operation in the control substrate **15** of the body **10**.

[0101] As described above, in the liquid transporting apparatus **1**, since it is a state where the body **10** cannot communicate with the controller **50** initially, the power consumption in the communication standby state is small. Then, if it is determined that the cartridge **20** that is a liquid storage section, and the body **10** are connected, the body **10** and the controller **50** are in a state of being capable of communicating. That is, communication between the body **10** and the controller **50** starts immediately before executing the liquid transportation operation. Therefore, it is possible to suppress the wasteful standby power consumption.

Modification Example

[0102] In the first embodiment, when the body **10** starts the communication with the controller **50**, ON/OFF of communication circuit is performed using the switch **17** that is a mechanical contact point (see FIGS. **8**A and **8**B), ON/OFF of the communication circuit may be performed by other means. For example, the communication circuit can be ON/OFF using terminals **172** instead of the switch **17**.

[0103] FIGS. **16**A and **16**B are schematic views describing ON/OFF of the communication circuit in a modification example. A basic configuration of a liquid transporting apparatus **1** of the modification example is substantially the same as that of the first embodiment, but the terminals **172** are provided instead of the switch **17** of the body **10** and a metal plate **237** having conductivity is provided as the contact section instead of the contact plate **236** of the cartridge **20**. The terminals **172** are a set of contact points provided on the side of the lower surface of the body **10** and, as illustrated in FIG. **16**A, when the body **10** and the cartridge **20** are not connected to each other, the communication circuit is in a state of being open (OFF). Then, as illustrated in FIG. **16**B, when the body **10** and the cartridge **20** are connected, the terminals **172** come into contact with the metal plate **237** so that the contact points are electrically connected and the communication circuit is in a state of being closed (ON). Therefore, it is determined that the body **10** and the cartridge **20** is normally connected. Then, similar to the first embodiment, if it is determined that the body **10** and the cartridge **20** are normally connected, the body **10** and the controller **50** are in a state of being capable of communicating. Therefore, in the modification example, it is also possible to suppress the wasteful standby power consumption.

Second Embodiment

[0104] In the second embodiment, a connection state between a body **10** and a cartridge **20** is determined by detecting the pressure when the cartridge **20** are set to the body **10** by a pressure sensitive sensor and this is used as a trigger when starting the communication between the body **10** and a controller **50**.

Pressure Sensitive Sensor

[0105] A configuration of a liquid transporting apparatus **1** in the second embodiment is substantially the same as that of the first embodiment, but a pressure sensitive sensor **71** is provided on a back surface of the body **10** instead of the switch **17** or the terminal **172** of the first embodiment. Similarly, a pressing section **72** is provided on an upper surface of the cartridge **20** instead of the contact plate **236** or the metal plate **237** of the first embodiment. The pressure sensitive sensor **71** and the pressing section **72** have a positional relationship of facing each other when the body **10** and the cartridge **20** are connected.

[0106] FIG. **17** is a perspective view of the back surface of the body **10** in the second embodiment. FIGS. **18**A and **18**B are views describing a structure of the pressure sensitive sensor **71**. FIGS. **19**A and **19**B are views describing a connection detection method using the pressure sensitive sensor. FIG. **20** is a view describing a state of an electrode when measuring a pressure by the pressure sensitive sensor **71**.

[0107] In the second embodiment, the plate-shaped pressure sensitive sensor **71** is provided on the back surface side of the body **10**. The pressure sensitive sensor is a pressure detection section that is capable of detecting the amount of pressure applied on the sensor portion by using that a resistance value is reduced when the pressure is applied to the sensor section. In the embodiment, the connection state of the cartridge **20** and the body **10** is determined by measuring the amount of

pressure when the pressing section **72** that is provided in the cartridge **20** presses the pressure sensitive sensor **71** that is provided in the body **10**.

[0108] The pressure sensitive sensor **71** has an electrode sheet **711**, a spacer **712** and a conductive sheet **713** in a vertical direction. The pressure that is applied to the surface side of the pressure sensitive sensor **71** (the electrode sheet **711**) is measured when measuring the pressure. The electrode sheet **711** is a film-shaped member of which the back surface has an electrode. In the electrode sheet **711** of the embodiment, as illustrated in A-A cross-sectional view of FIG. **18**B, electrodes **711***a* and electrodes **711***b* are finely spread so there is no contact between them. That is, in this state, the electrodes **711***a* and the electrodes **711***b* are not conductive. The spacer **712** is a member that is provided between the electrode sheet **711** and the conductive sheet **713**, and is for isolating the electrodes **711***a* and the electrode **711***bs* so there is no contact between them. The conductive sheet **713** is a sheet-shaped member that is provided to face the electrodes **711***a* and the electrodes **711***b* of the electrode sheet **711**, and has conductivity. Further, the electrodes **711***a* and the electrodes **711***b* are connected respectively, to a pressure-sensitive determination section **75** and it is possible to detect a resistance value of the pressure sensitive sensor **71** by the pressure-sensitive determination section **75**. The pressure is measured, based on the resistance value that is detected, and the determination of the connection state of the cartridge **20** and the body **10** is performed. The pressure-sensitive determination section **75** is provided in a control substrate **15** (a body control section).

[0109] FIG. **19**A illustrates a state before the cartridge **20** and the body **10** are connected. In this state, as described in FIGS. **18**A and **18**B, the electrode **711***a* and the electrode **711***b* are not conductive. Thus, a great resistance value is detected in the pressure-sensitive determination section **75**. On the other hand, FIG. **19**B illustrates a state that the cartridge **20** and the body **10** are connected. Both members are connected and then the pressing section **72** that is provided in the cartridge **20** presses the pressure sensitive sensor **71** from the surface side to the back surface side (from the lower side to the upper side). Therefore, the electrode sheet **711** is pressed against the conductive sheet **713** and a region (a contact region) coming into contact with the conductive sheet **713** is formed on a surface (the back surface side) of the electrode sheet **711** on which the electrodes is provided. A region illustrated in a hatched section of FIG. **20** is the contact region that is formed on the electrode sheet **711**. Since the electrode **711***a* and the electrode **711***b* are conductive through the conductive sheet **713** in the contact region, the resistance value that is detected by the pressure-sensitive determination section **75** is smaller than that of the non-contact state (the state of FIGS. **18**A and **18**B). Then, if the pressure by the pressing section **72** is great, since a contact area between the electrode **711***a* and the electrode **711***b*, and the conductive sheet **713** is great, the resistance value that is detected by the pressure-sensitive determination section **75** is further reduced.

[0110] That is, if the cartridge **20** and the body **10** are correctly connected, since the pressure sensitive sensor **71** is pressed strongly by the pressing section **72**, the resistance value that is detected by the pressure-sensitive determination section **75** is small. Conversely, if the cartridge **20** and the body **10** are not correctly connected, the resistance value that is detected by the pressure-sensitive determination section **75** is great. Therefore, if the resistance value that is detected is a predetermined threshold or less, the pressure-sensitive determination section **75** determines that the connection state of the cartridge **20** and the body **10** is normal, and if the resistance value that is detected is greater than a predetermined threshold, the pressure-sensitive determination section **75** determines that the connection state of the cartridge **20** and the body **10** is not normal. In other words, if the pressure when the pressure sensitive sensor **71** is pressed by the pressing section **72** is a predetermined amount or more, it is determined that the connection state of the cartridge **20** and the body **10** is normal.

[0111] Moreover, a setting position of the pressure sensitive sensor **71** is not limited to the example described above. For example, when the pressure sensitive sensor may be provided in a position facing a tube **21** and when the cartridge **20** and the body **10** are connected, the pressure to the pressure sensitive sensor by the tube **21** may be detected. Further, the structure of the sensor itself is also not limited to the example described above and it may be a method for detecting the pressure in a manner other than using the change in the resistance value.

Setting of Communication in Second Embodiment

[0112] A setting of the communication in the second embodiment is basically the same as that of the first embodiment. That is, the setting of the communication is performed according to the flow described in FIG. **15**.

[0113] However, in the second embodiment, in S**102** of FIG. **15**, the determination that the cartridge **20** and the body **10** are correctly connected is performed by the pressure determination using the pressure sensitive sensor. Particularly, in S**102**, the pressure is detected that is applied to the body **10** by the cartridge **20** as the resistance value, and determines the connection state, based on the resistance value that is detected. If it is determined that the connection state of the cartridge **20** and the body **10** is normal, the body control section causes the communication circuit to be ON and to be a state of being capable of communicating with the controller **50**. Thereafter, pairing of the body **10** between the controller **50** is performed (S**103**) and the communication starts practically (S**104**).

[0114] According to the liquid transporting apparatus **1** of the second embodiment, since the communication with the controller **50** is not started before the body **10** and the cartridge **20** are correctly connected, it is possible to reduce the power consumption during the communication standby. Then, the body **10** and the controller **50** are in a state being capable of communicating for the first time in a stage in which it is determined that the connection state of the both members is normal from a result of measurement of the pressure when the body **10** and the cartridge **20** are connected.

OTHER EMBODIMENTS

[0115] The embodiments described above are intended to facilitate understanding of the invention and are not intended to be constructed as limiting the invention. The invention may be altered and improved as long as there is no departure from the spirit thereof, and it is needless to say that equivalents thereof are included in the invention.

[0116] The entire disclosure of Japanese Patent Application No. 2013-076630, filed Apr. 2, 2013 is expressly incorporated by reference herein.

What is claimed is:

1. A liquid transporting apparatus comprising:

a liquid storage section that stores a liquid;

a body section that supports a driving section having at least a part of function for transporting the liquid and is connected to the liquid storage section when transporting the liquid; and

a body control section that controls an operation of the driving section and determines whether the body section and the liquid storage section are connected,

wherein if it is determined that the body section and the liquid storage section are connected, communication between the body control section and an external control section that communicates with the body control section and performs instruction to control operation of the driving section is started.

2. The liquid transporting apparatus according to claim **1**,

wherein the body section includes a communication circuit that performs communication with the external control section,

wherein the communication circuit has a contact point that is in a closed state by coming into contact with a contact section that is provided in the liquid storage section, and

wherein the body control section determines that the body section and the liquid storage section are connected if the contact point is in the closed state.

3. The liquid transporting apparatus according to claim **1**,

wherein a pressure detection section that measures the pressure is provided in the body section, and

wherein the body control section measures an amount of pressure when the pressure detection section is pressed by a pressing section that is provided in the liquid storage section, and determines that the body section and the liquid storage section are connected if the pressure that is measured has a predetermined amount or more.

4. The liquid transporting apparatus according to claim **1**,

wherein the body section includes a battery storage section that stores a battery as a power supply of the liquid transporting apparatus, and holds the body control section.

5. The liquid transporting apparatus according to claim **1**,

wherein information including a type and a storage amount of the liquid which is stored in the liquid storage section is recorded in the liquid storage section, and

wherein the information is acquired by the external control section.

6. The liquid transporting apparatus according to claim **1**,

wherein the communication between the external control section and the body control section is performed using radio, and

wherein the setting of connection is performed between the external control section and the body control section before the communication is started.

7. The liquid transporting apparatus according to claim **1**, further comprising:

a battery as a power supply of the liquid transporting apparatus.

8. The liquid transporting apparatus according to claim **1**, further comprising:

the external control section.

9. A liquid transporting apparatus comprising:

a liquid storage section that stores a liquid;

a body section that supports a driving section having at least a part of function for transporting the liquid and is connected to the liquid storage section when transporting the liquid; and

a body control section that controls an operation of the driving section and determines whether the body section and the liquid storage section are connected,

wherein if it is determined that the body section and the liquid storage section are connected, the body control section is set to be capable of communicating with an external control section that communicates with the body control section and performs instruction to control operation of the driving section.

10. The liquid transporting apparatus according to claim **9**,

wherein if it is determined that the body section and the liquid storage section are connected, the communication between the external control section and the body control section is started.

11. The liquid transporting apparatus according to claim **9**, further comprising:

the external control section.

12. A liquid transporting method comprising:

determining whether a liquid storage section that stores a liquid and a body section that supports a driving section having at least a part of function for transporting the liquid and is connected to the liquid storage section when the liquid is transported are in a state of being connected;

starting the communication to the external control section if it is determined that the body section and the liquid storage section are connected; and

transporting the liquid by an instruction from the external control section.

* * * * *