US 20200178899A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2020/0178899 A1**

CHAE et al. (43) **Pub. Date: Jun. 11, 2020**

(54) **SENSOR APPLICATOR ASSEMBLY FOR CONTINUOUS GLUCOSE MONITORING SYSTEM**

(71) Applicant: **I-SENS, INC.**, Seoul (KR)

(72) Inventors: **Kyung Chul CHAE**, Gyeonggi-do (KR); **Hyun Ho CHOI**, Seoul (KR); **Goang Yel RYU**, Gyeonggi-do (KR); **Young Jea KANG**, Seoul (KR); **Ji Hoon WANG**, Gyeonggi-do (KR)

(21) Appl. No.: **16/618,360**

(22) PCT Filed: **Jun. 1, 2018**

(86) PCT No.: **PCT/KR2018/006313**

§ 371 (c)(1),
(2) Date: **Dec. 1, 2019**

(30) **Foreign Application Priority Data**

Jun. 2, 2017 (KR) 10-2017-0068964
Jun. 1, 2018 (KR) 10-2018-0063368

Publication Classification

(51) **Int. Cl.**
A61B 5/00 (2006.01)
A61B 5/145 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 5/68335*** (2017.08); ***A61B 5/14532*** (2013.01); *A61B 2560/063* (2013.01); *A61B 5/14503* (2013.01); ***A61B 5/6849*** (2013.01)

(57) **ABSTRACT**

The present invention relates to a sensor applicator assembly for a continuous glucose monitoring system and provides a sensor applicator assembly for a continuous glucose monitoring system, which is manufactured with a sensor module assembled inside an applicator, thereby minimizing additional work by a user for attaching the sensor module to the body and allowing the sensor module to be attached to the body simply by operating the applicator, and thus can be used more conveniently. A battery is built in the sensor module and a separate transmitter is connected to the sensor module so as to receive power supply from the sensor module and be continuously used semi-permanently, thereby making the assembly economical. The sensor module and the applicator are used as disposables, thereby allowing accurate and safe use and convenient maintenance.

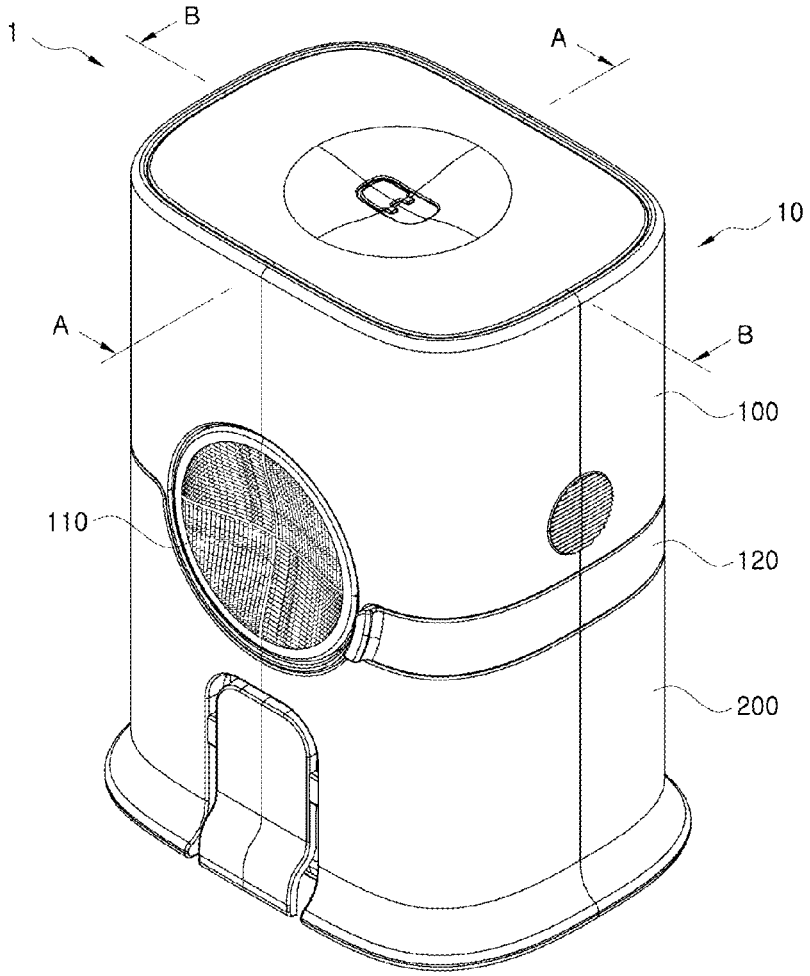


FIG. 1

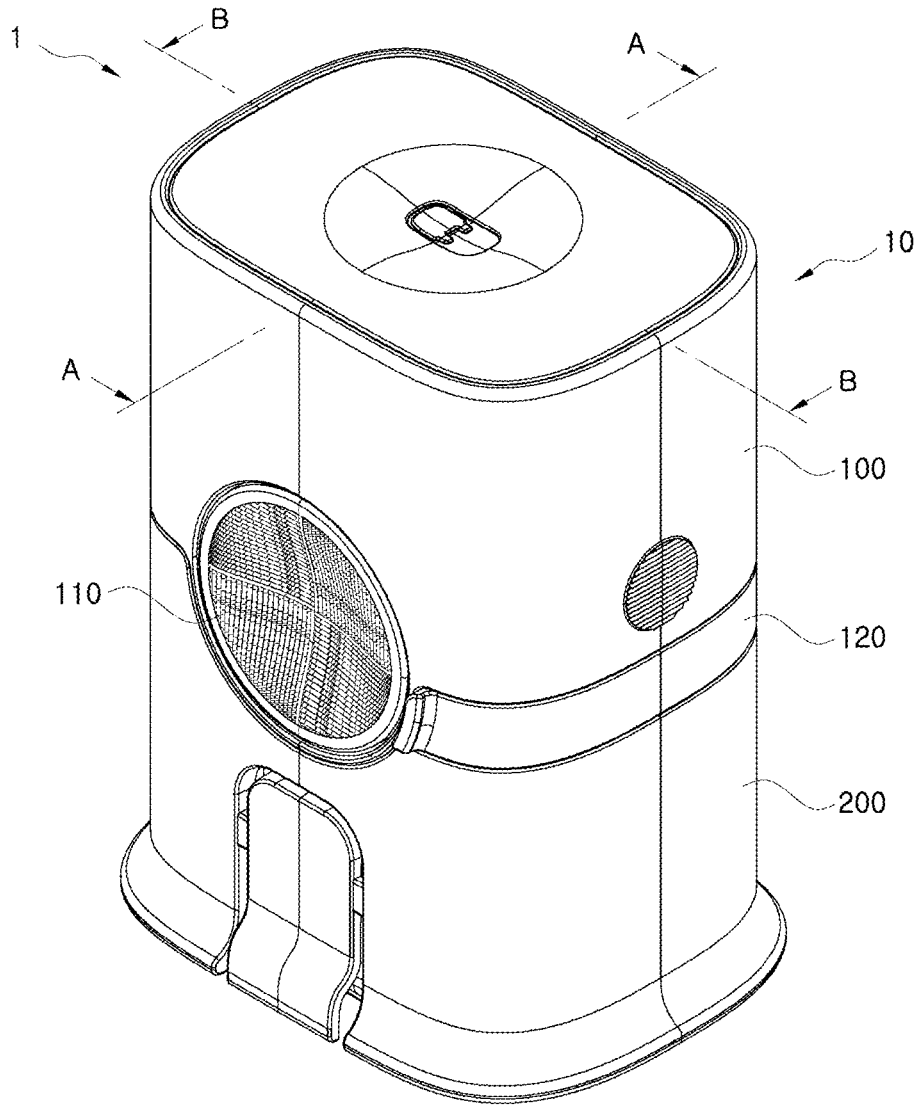


FIG. 2

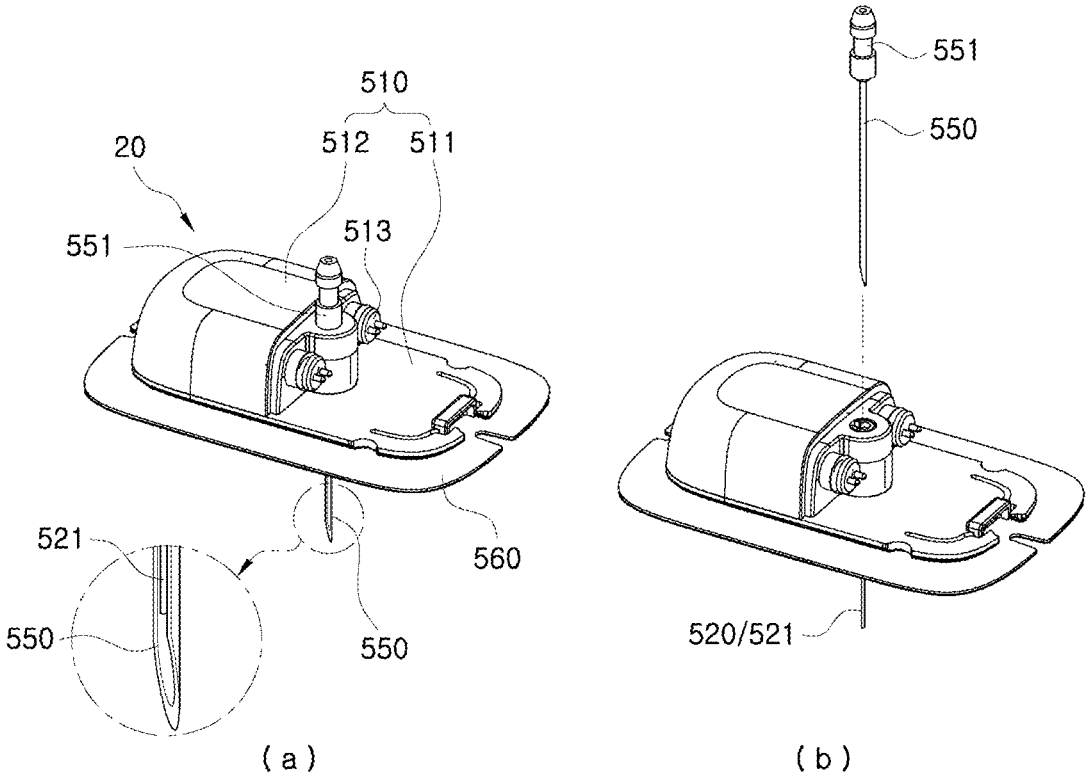


FIG. 3

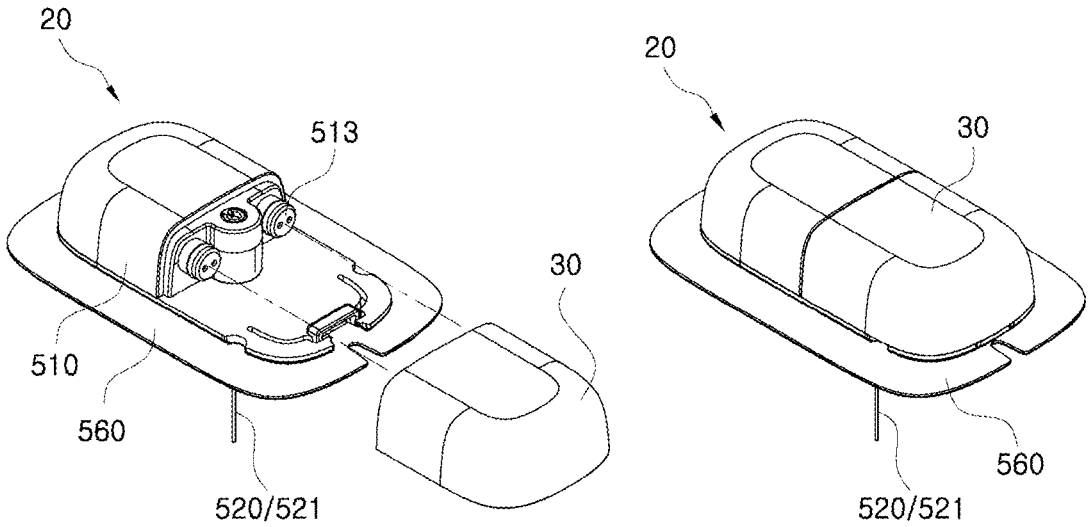


FIG. 4

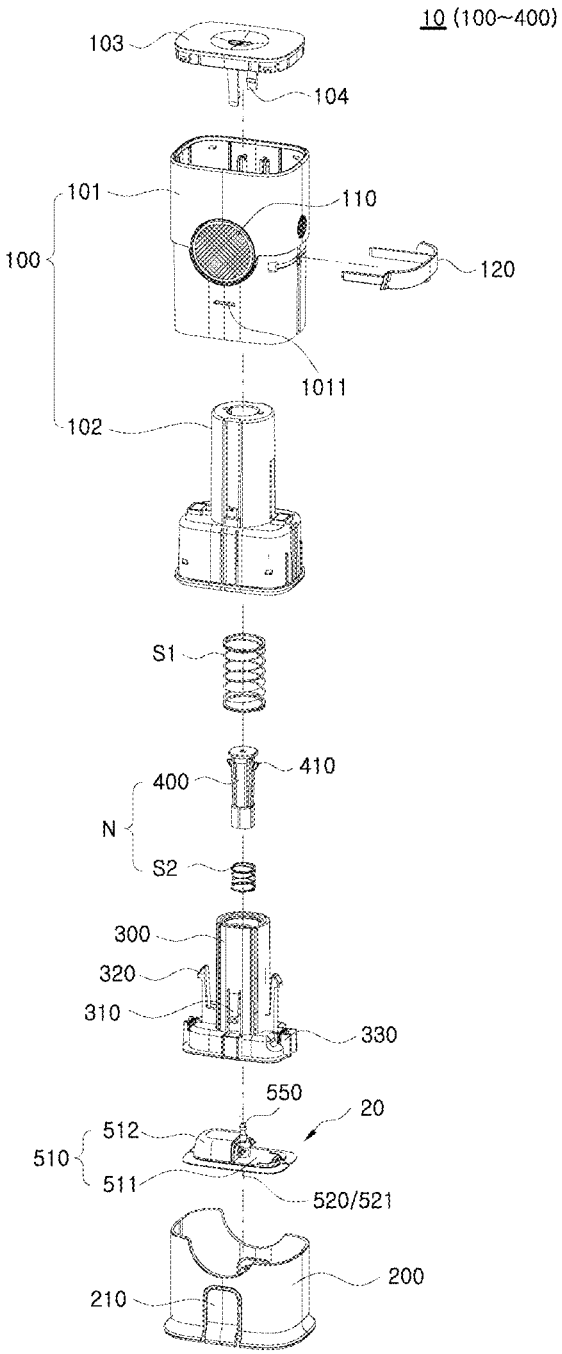

10 (100~400)
103
104
101
110
100
120
1011
102
S1
410
400
N
S2
300
320
310
330
550
20
512
510
511
520/521
200
210

FIG. 5

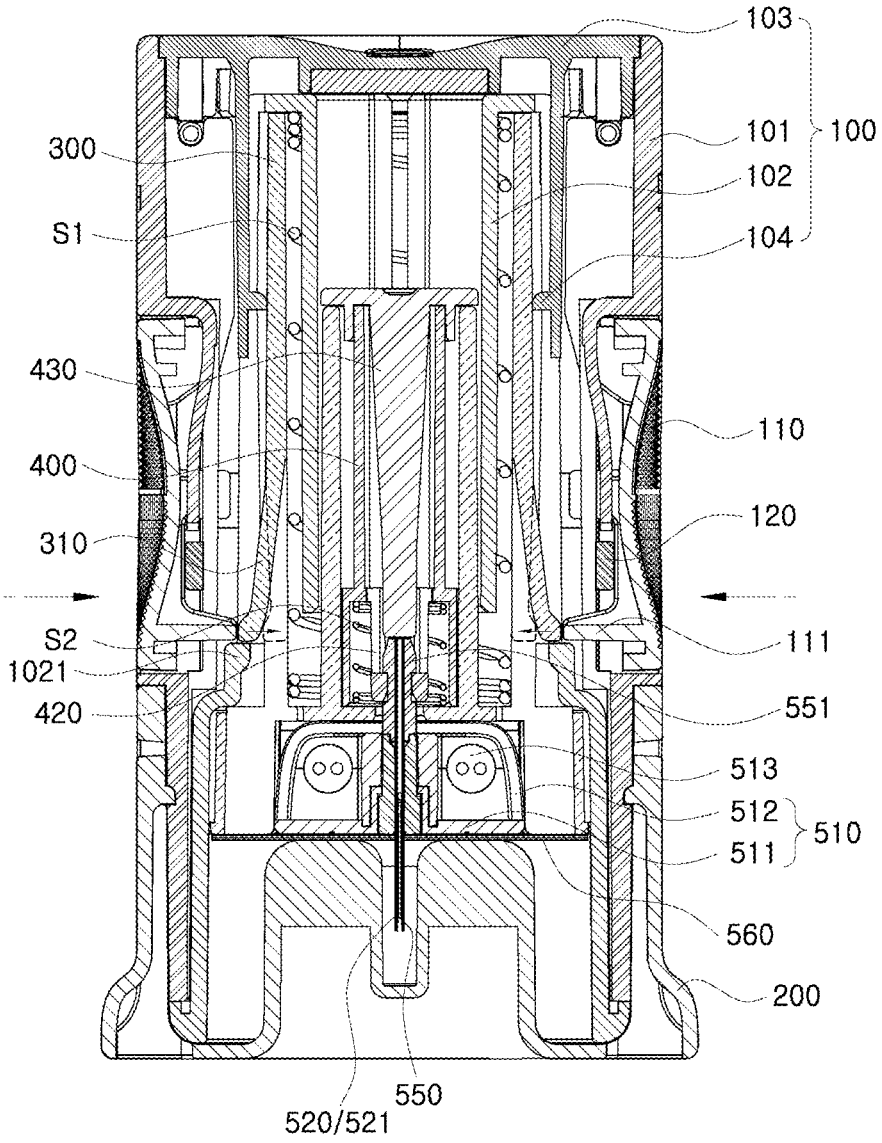

103
101
100
102
104
300
S1
430
110
400
120
310
S2
111
1021
420
551
513
512
510
511
560
200
550
520/521

FIG. 6

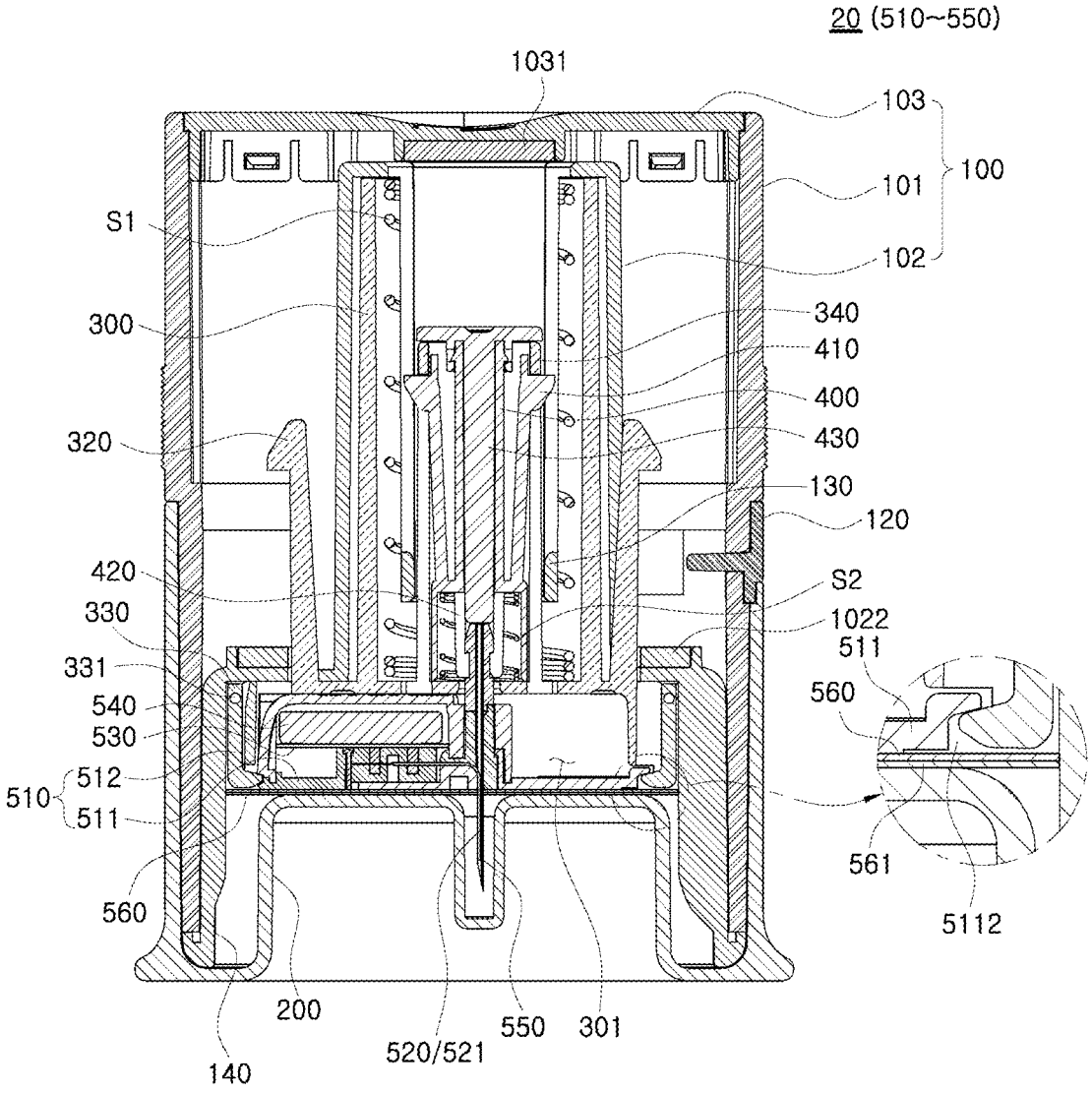

20 (510~550)
1031
103
100
101
102
S1
300
340
410
400
430
320
130
120
420
S2
330
1022
511
331
560
540
530
512
510
511
560
561
5112
200
550
301
520/521
140

FIG. 7

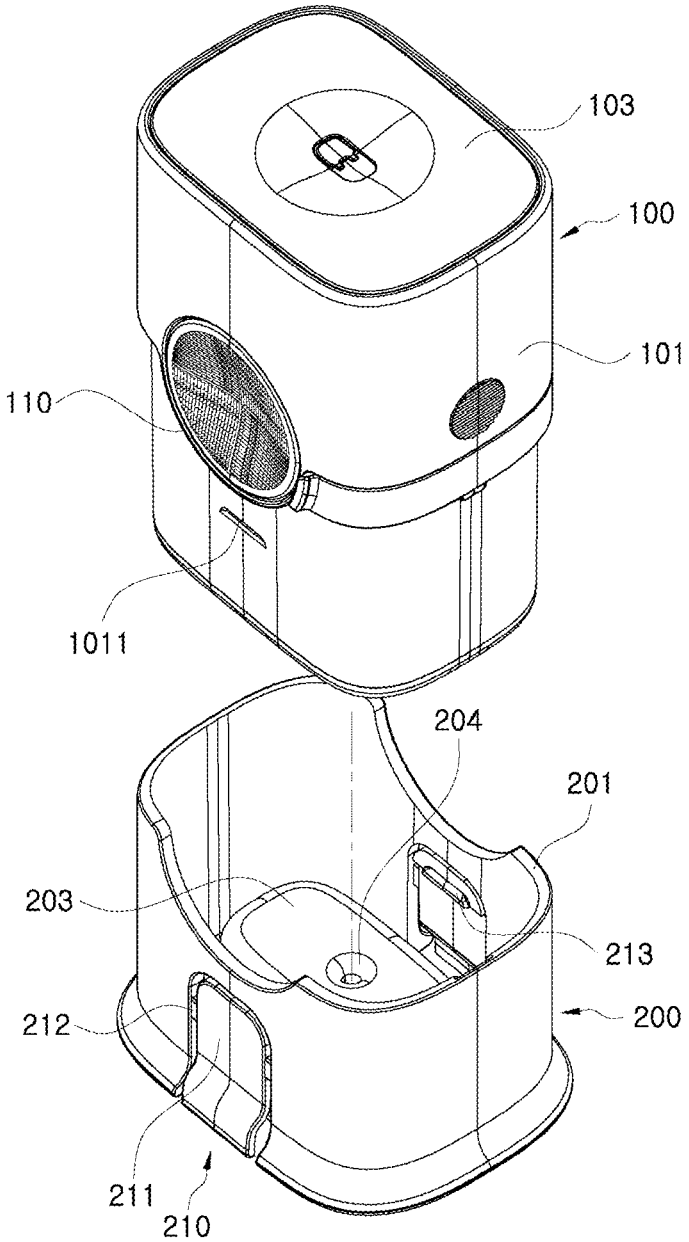


FIG. 8A

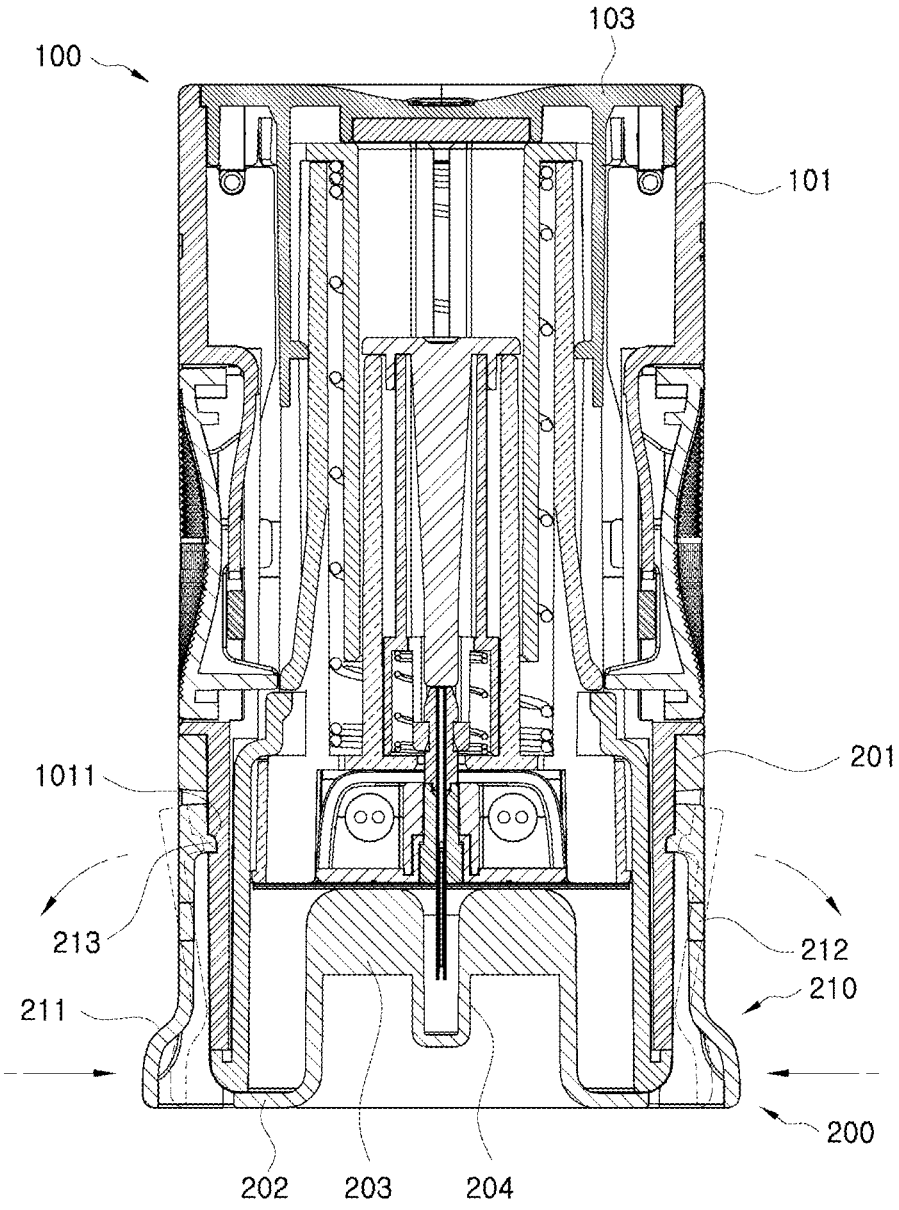


FIG. 8B

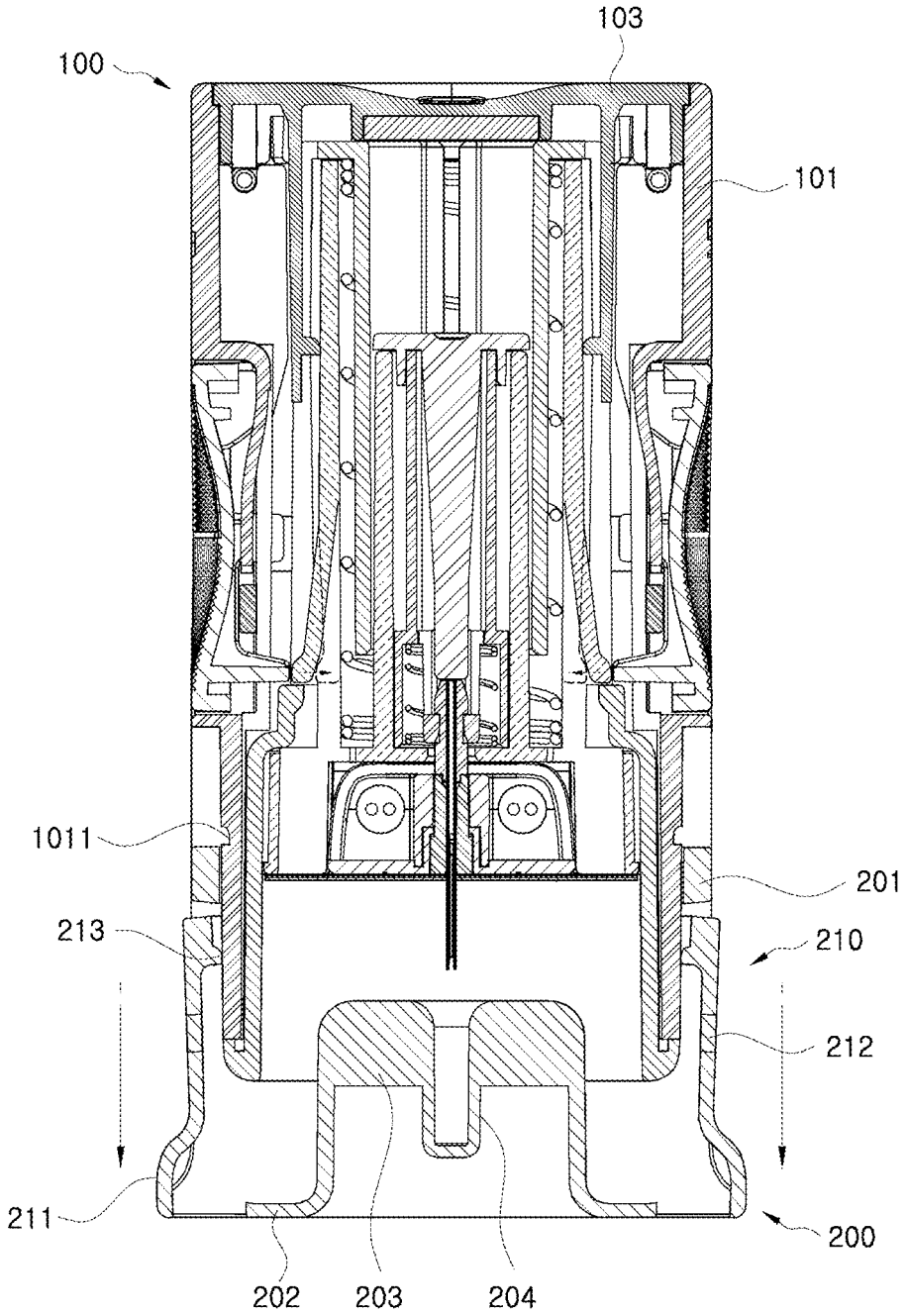


FIG. 9A

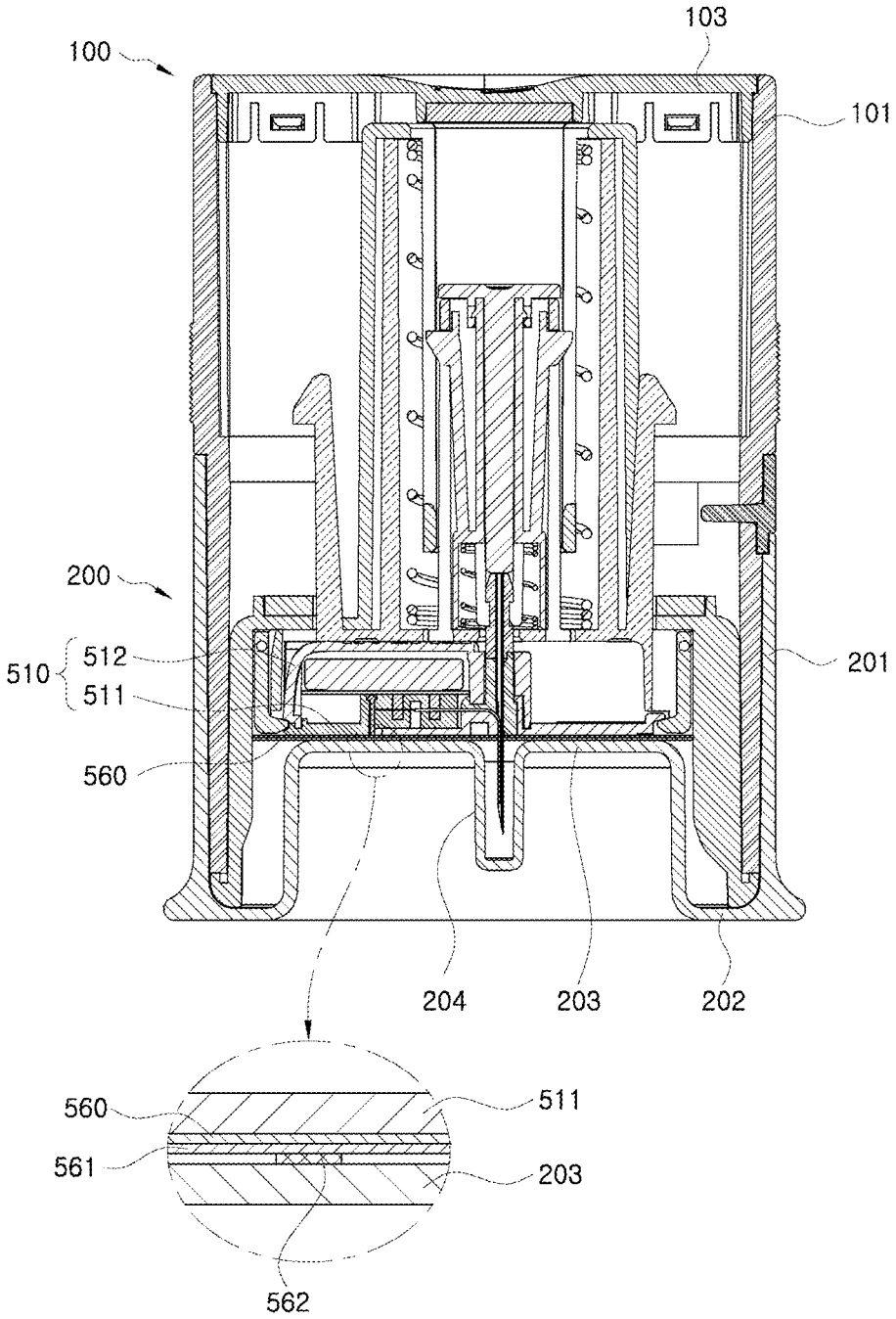

103
100
101
200
510
512
511
560
201
204
203
202
560
511
561
203
562

FIG. 9B

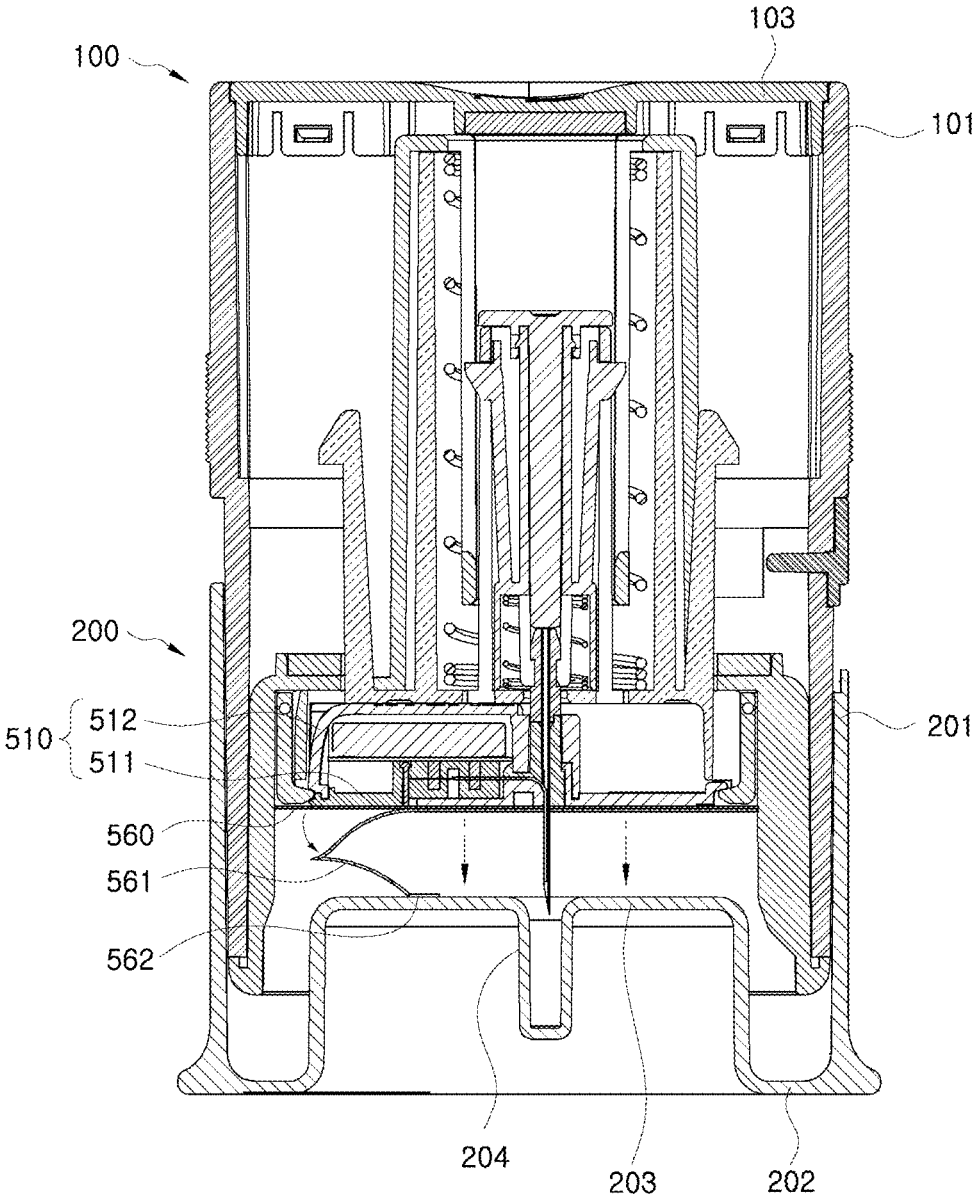


FIG. 10

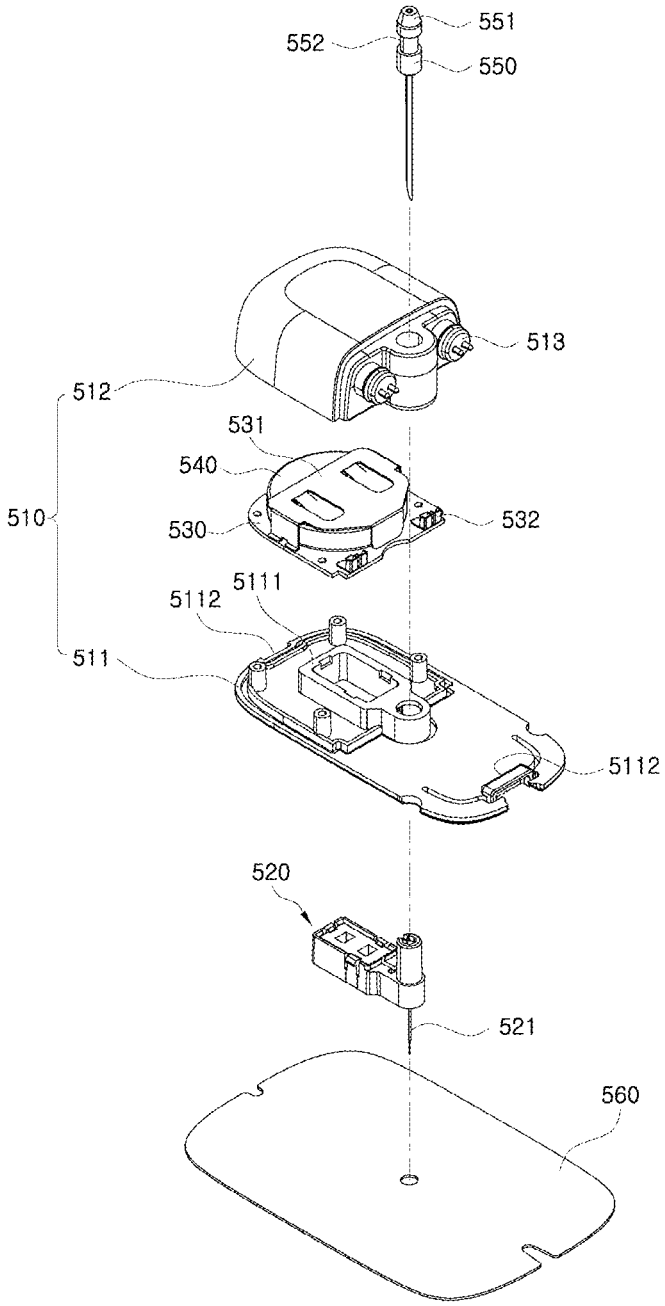

551
552
550
513
512
531
540
510
530
532
5111
5112
511
5112
520
521
560

FIG. 11

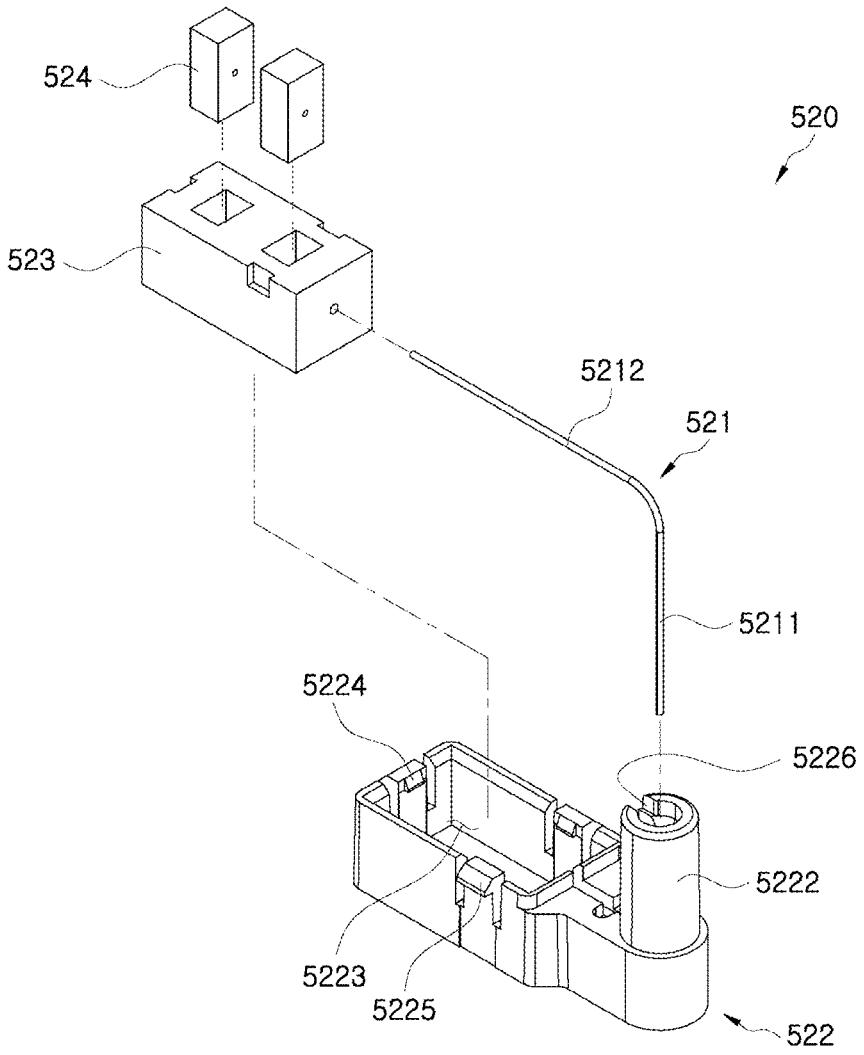


FIG. 12

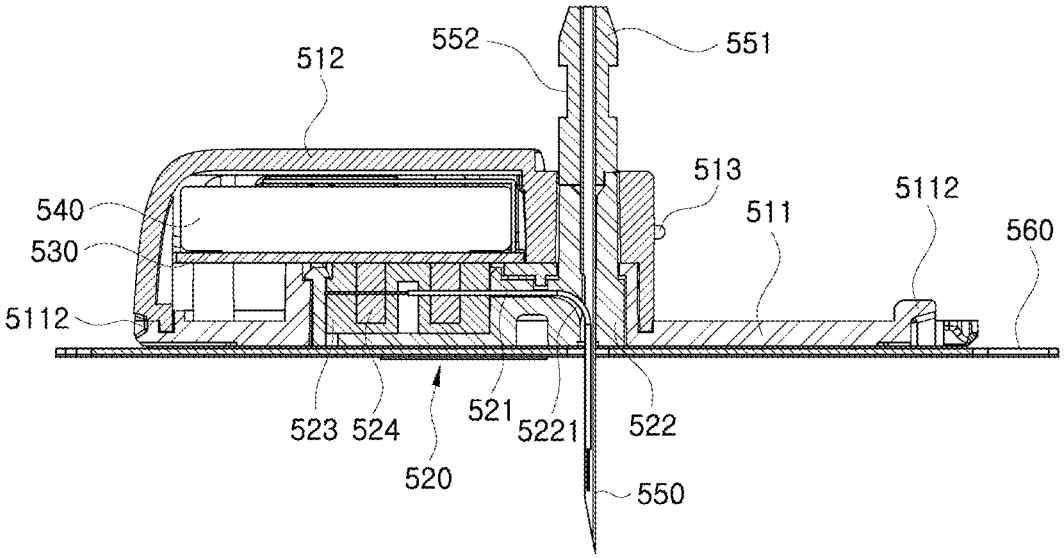

552
551
512
513
5112
511
560
540
530
5112
523
524
521
5221
522
520
550

FIG. 13

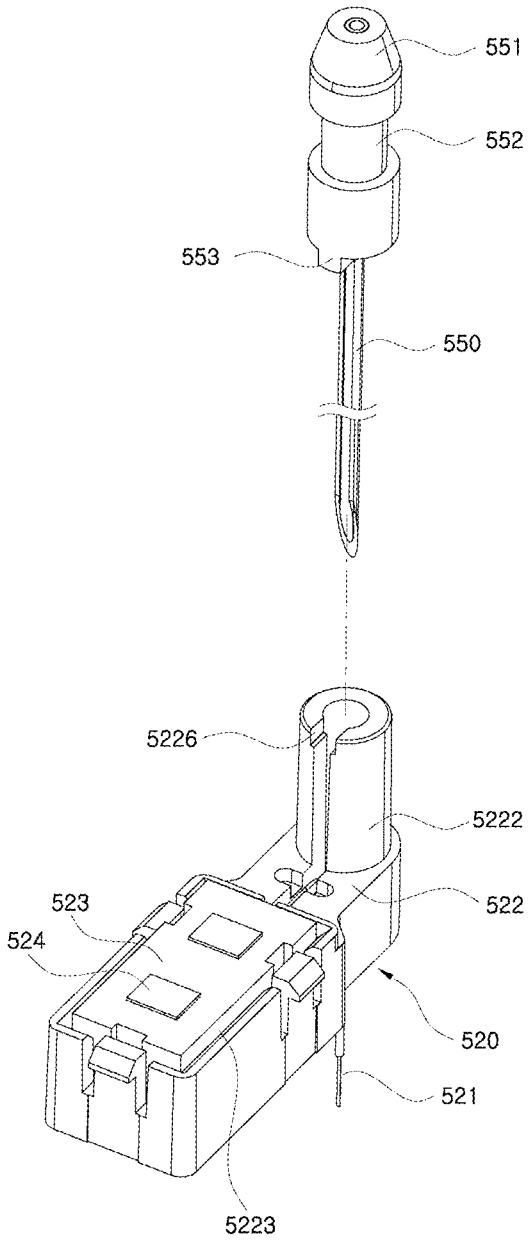


FIG. 14

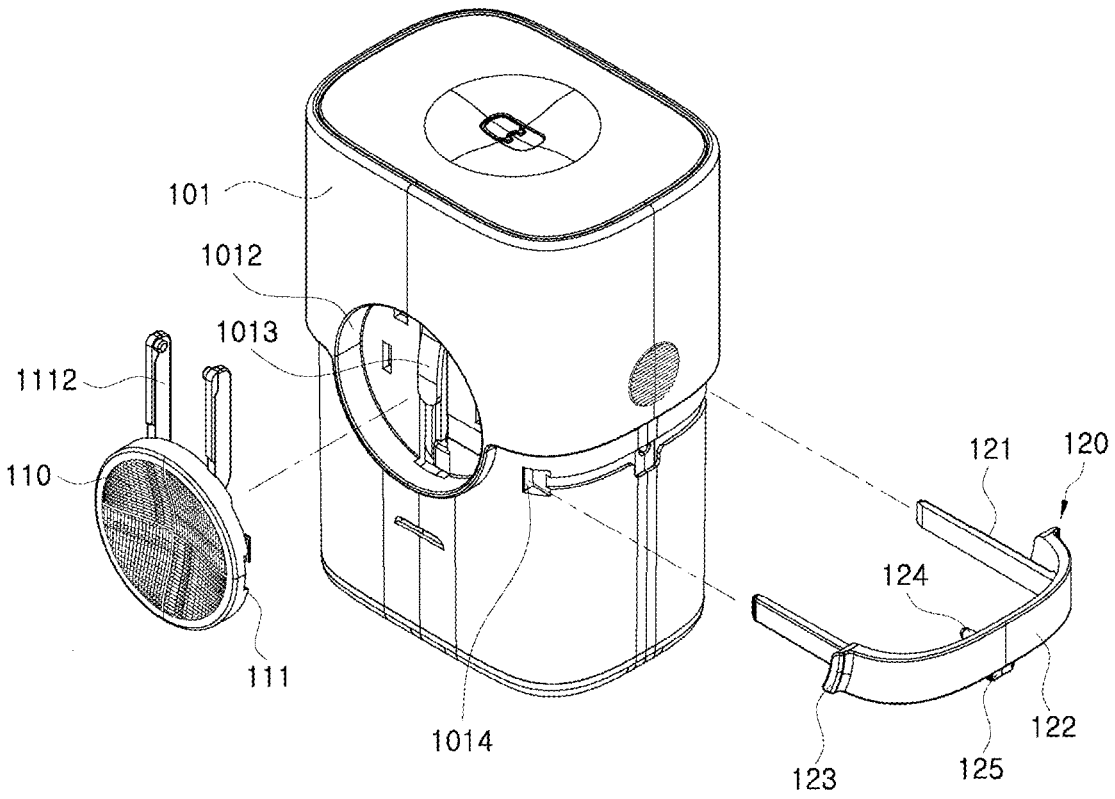


FIG. 15

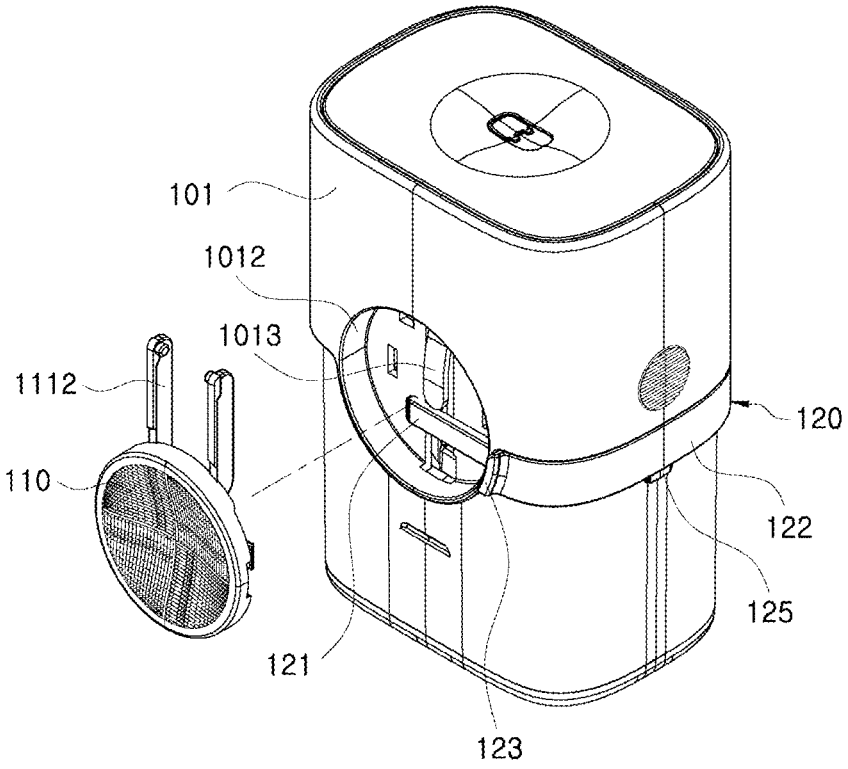


FIG. 16A

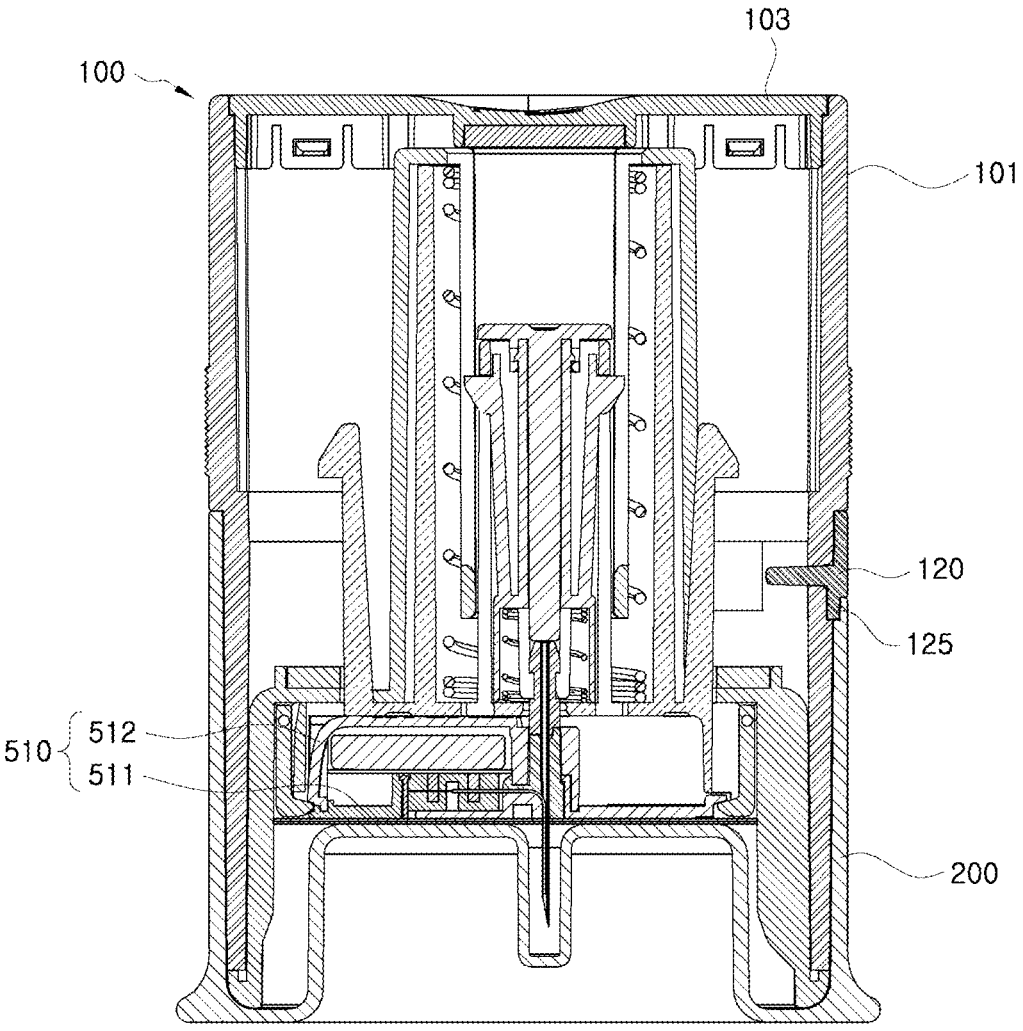


FIG. 16B

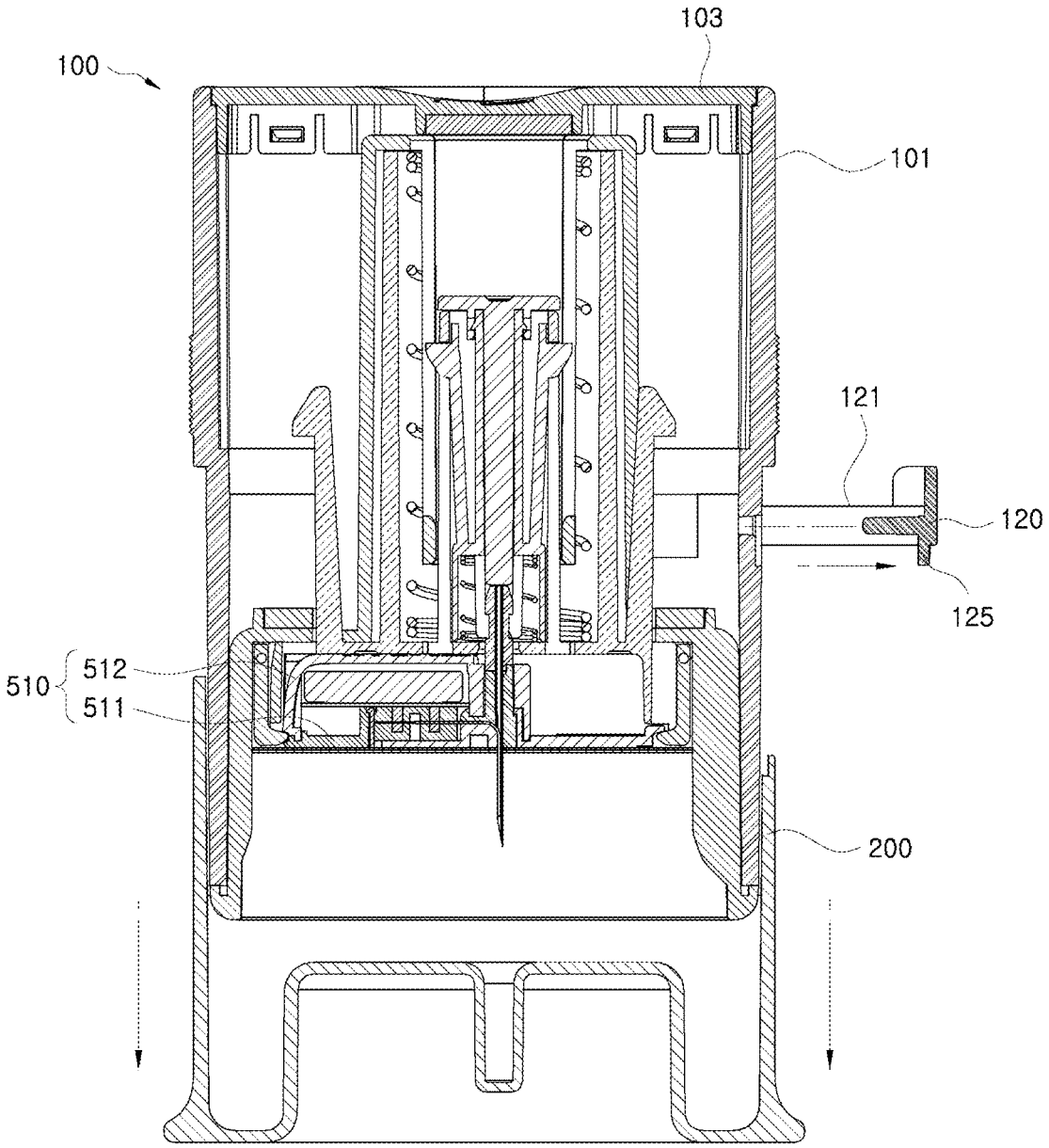


FIG. 17

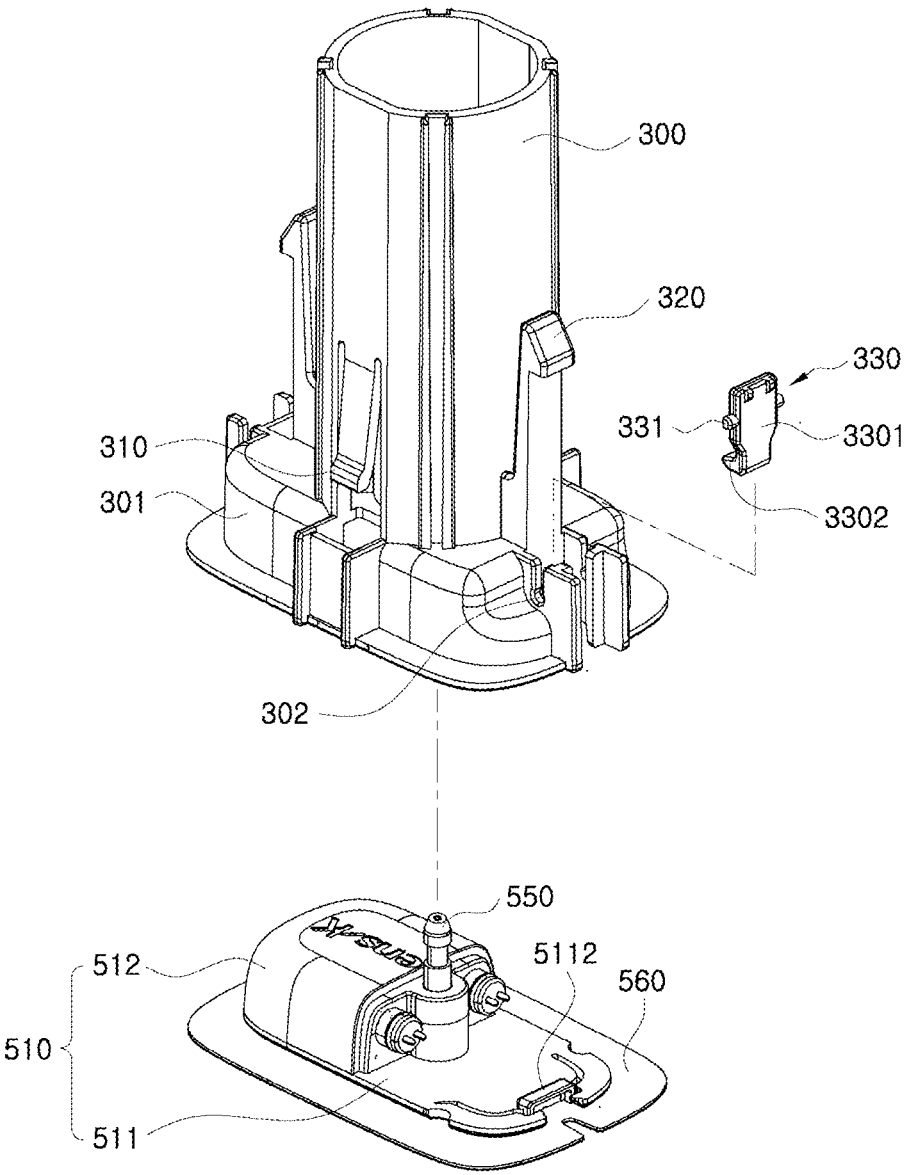


FIG. 18A

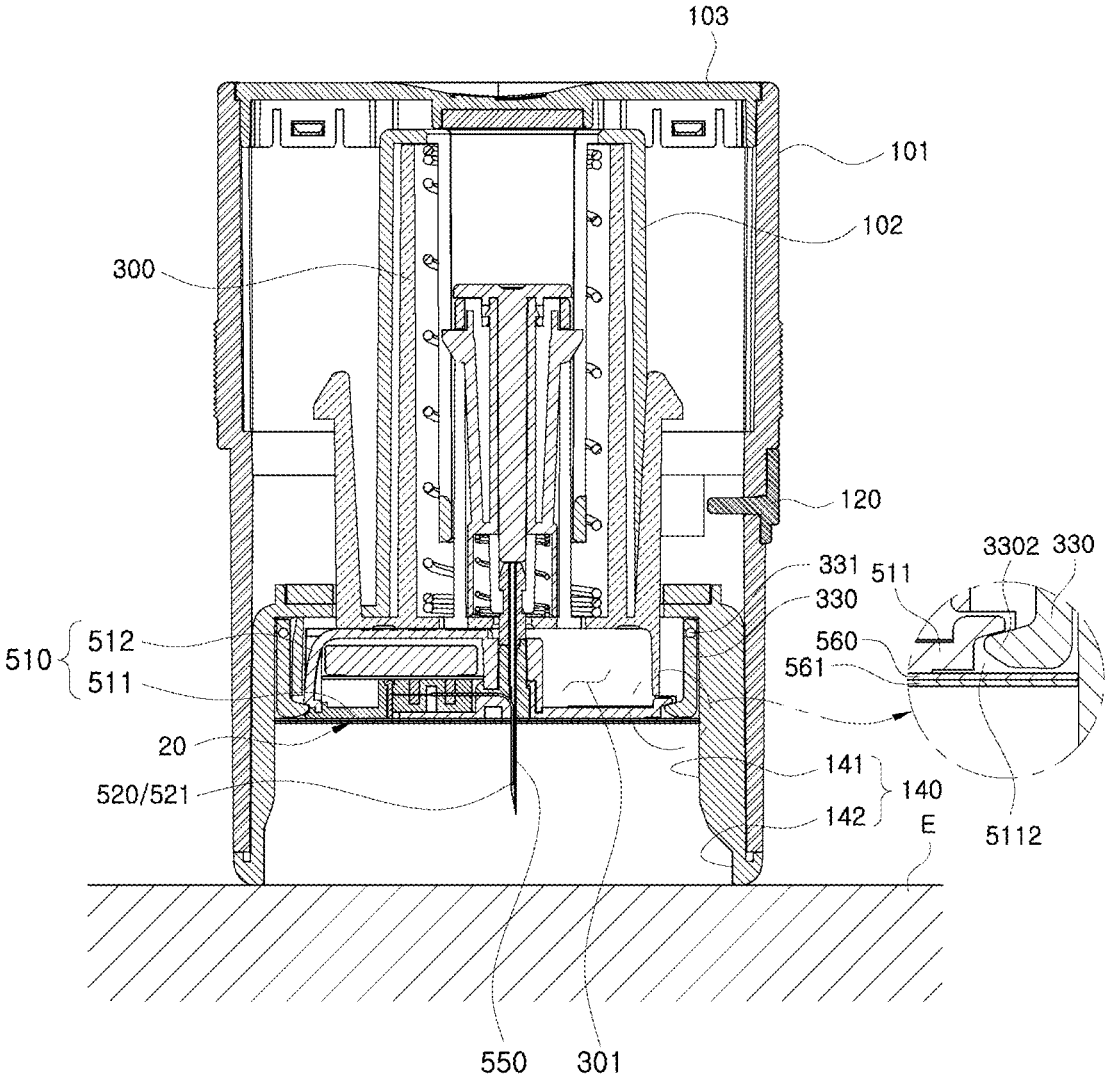

103
101
102
300
120
3302
330
331
511
330
560
561
510
512
511
20
520/521
141
140
142
E
5112
550
301

FIG. 18B

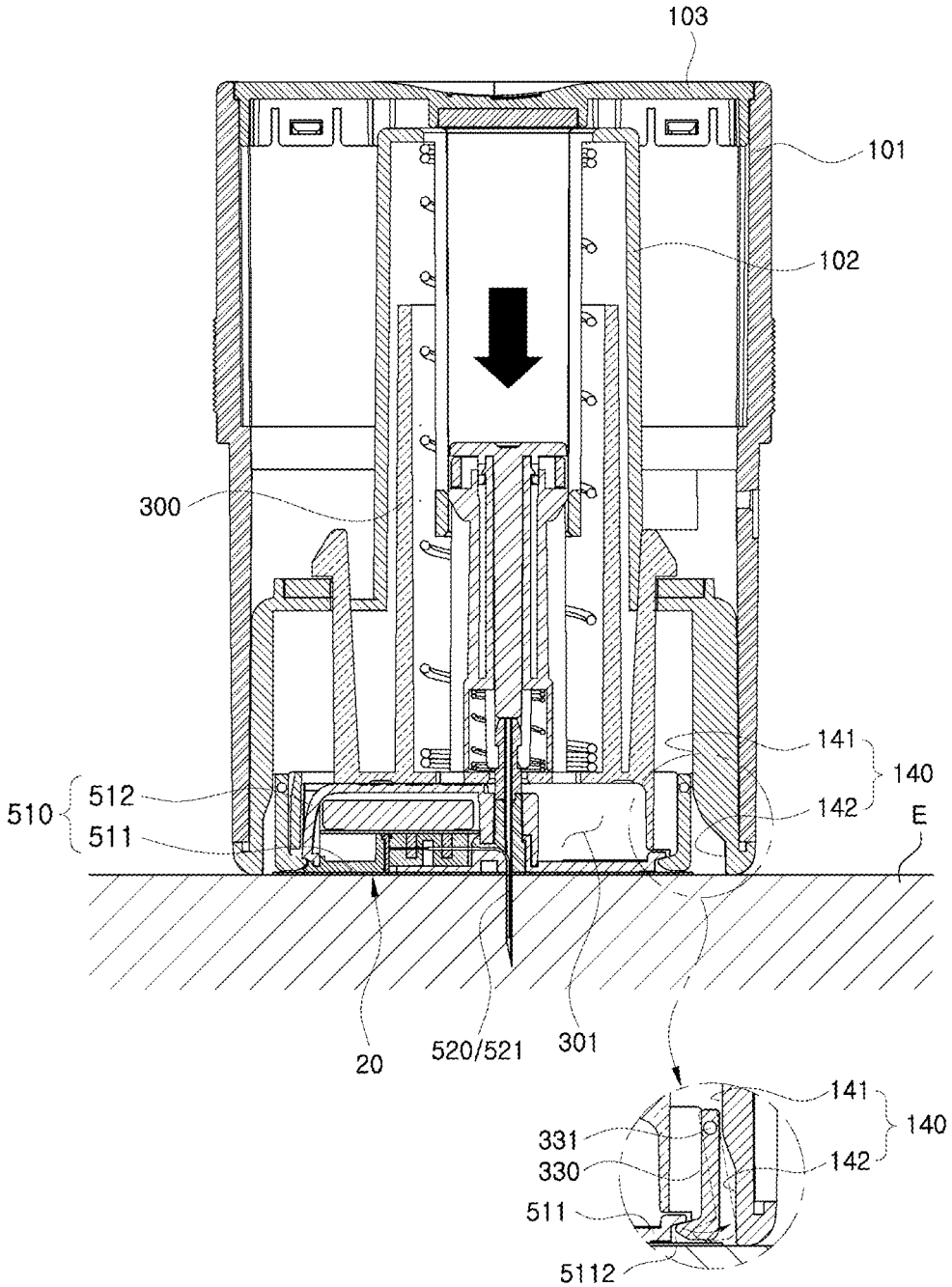

103
101
102
300
141
140
142
510
512
511
E
20
520/521
301
141
140
331
330
142
511
5112

FIG. 19A

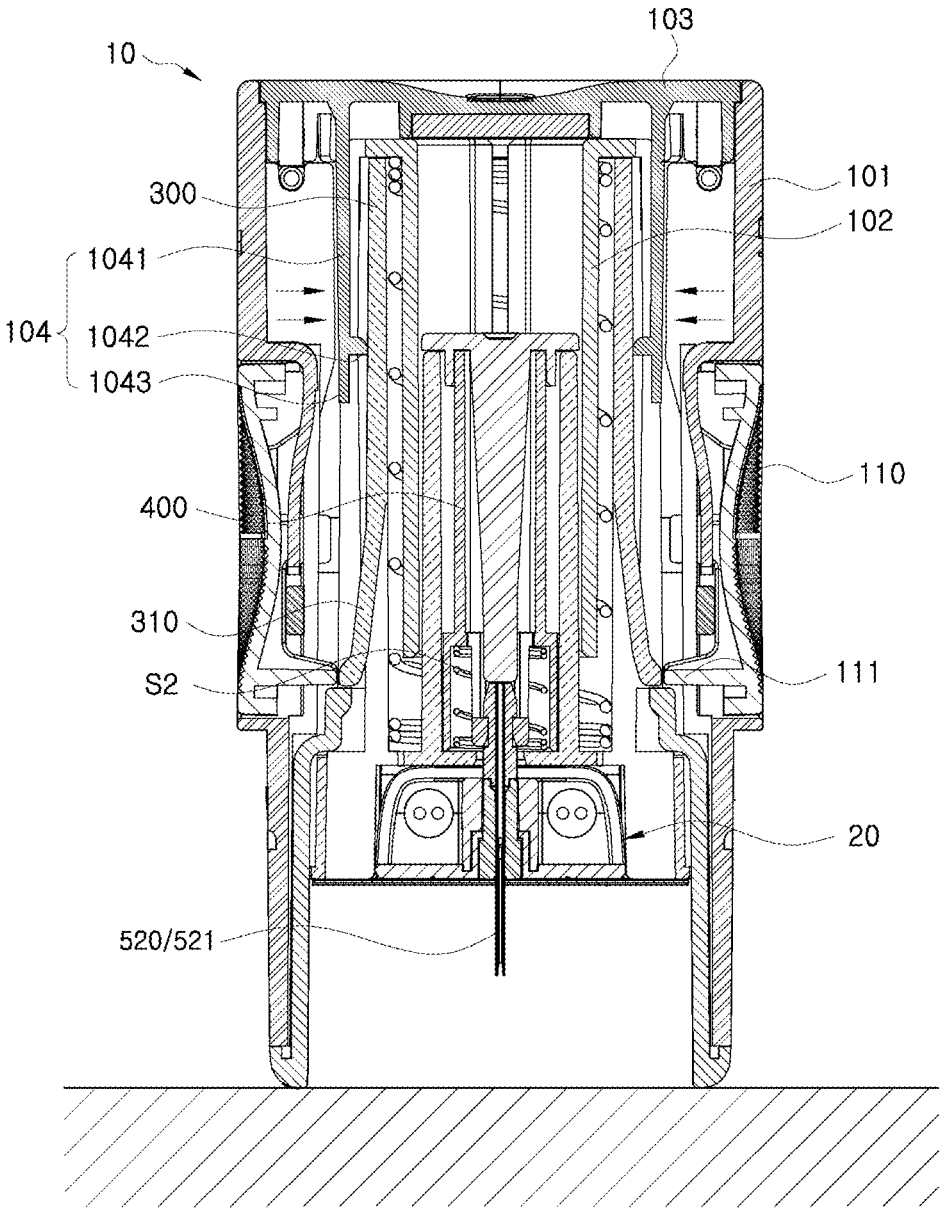

103
10
101
300
102
1041
104
1042
1043
110
400
310
111
S2
20
520/521

FIG. 19B

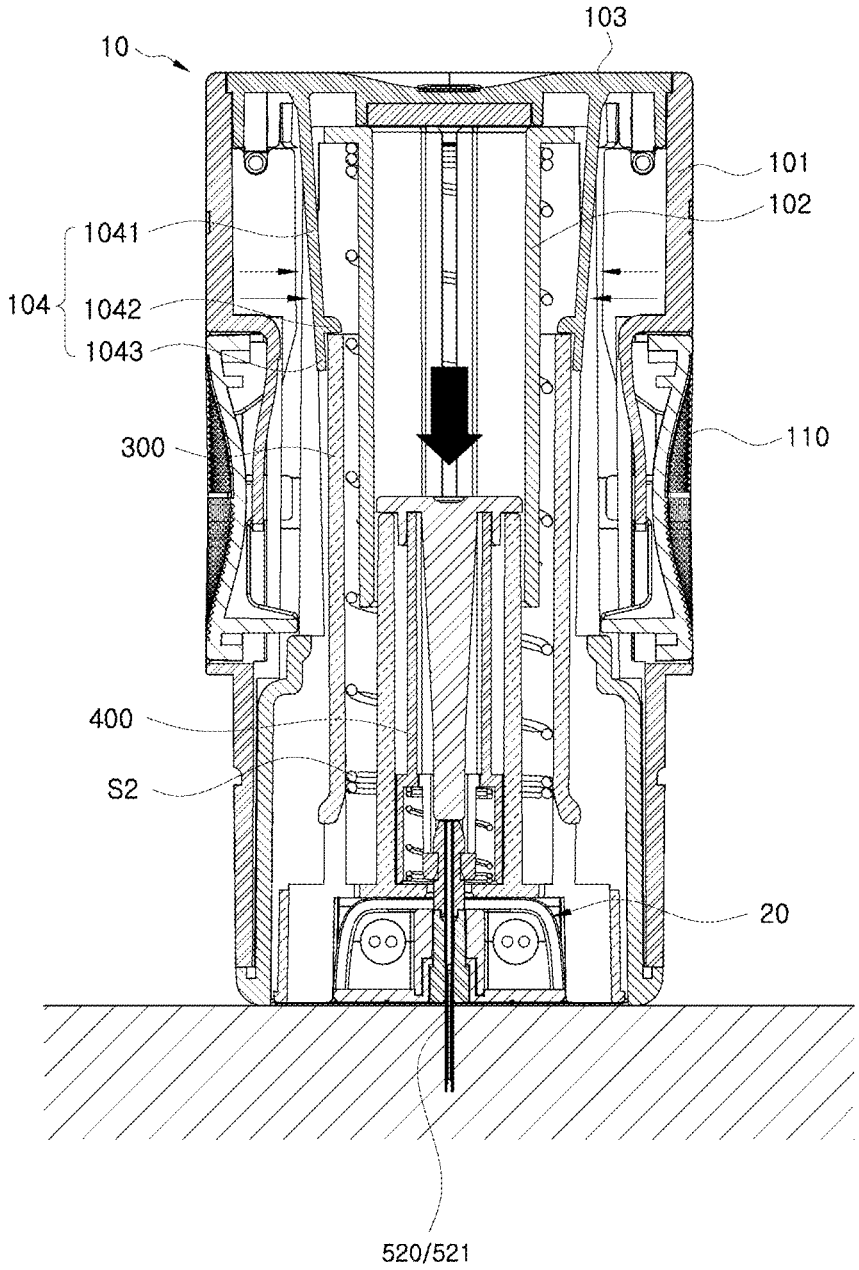


FIG. 20

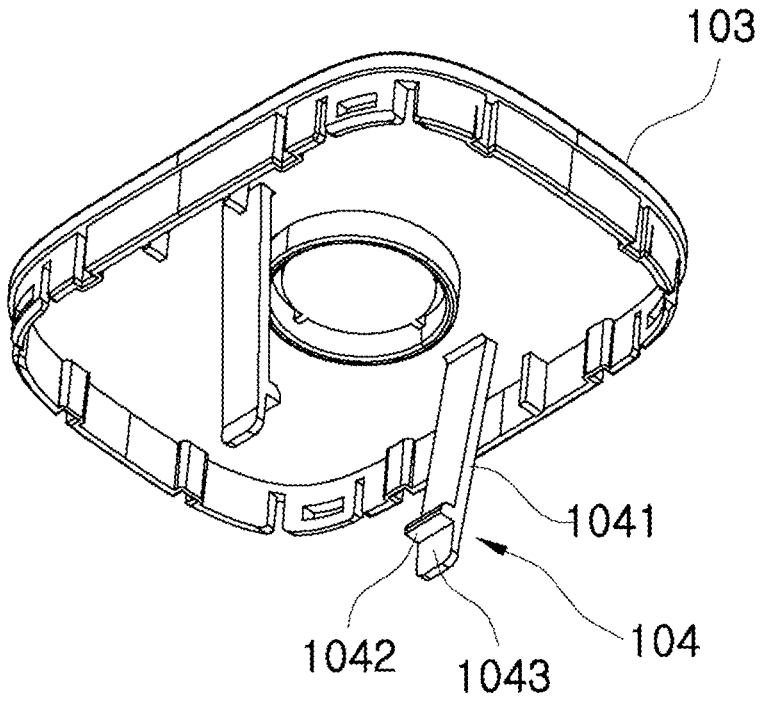


FIG. 21

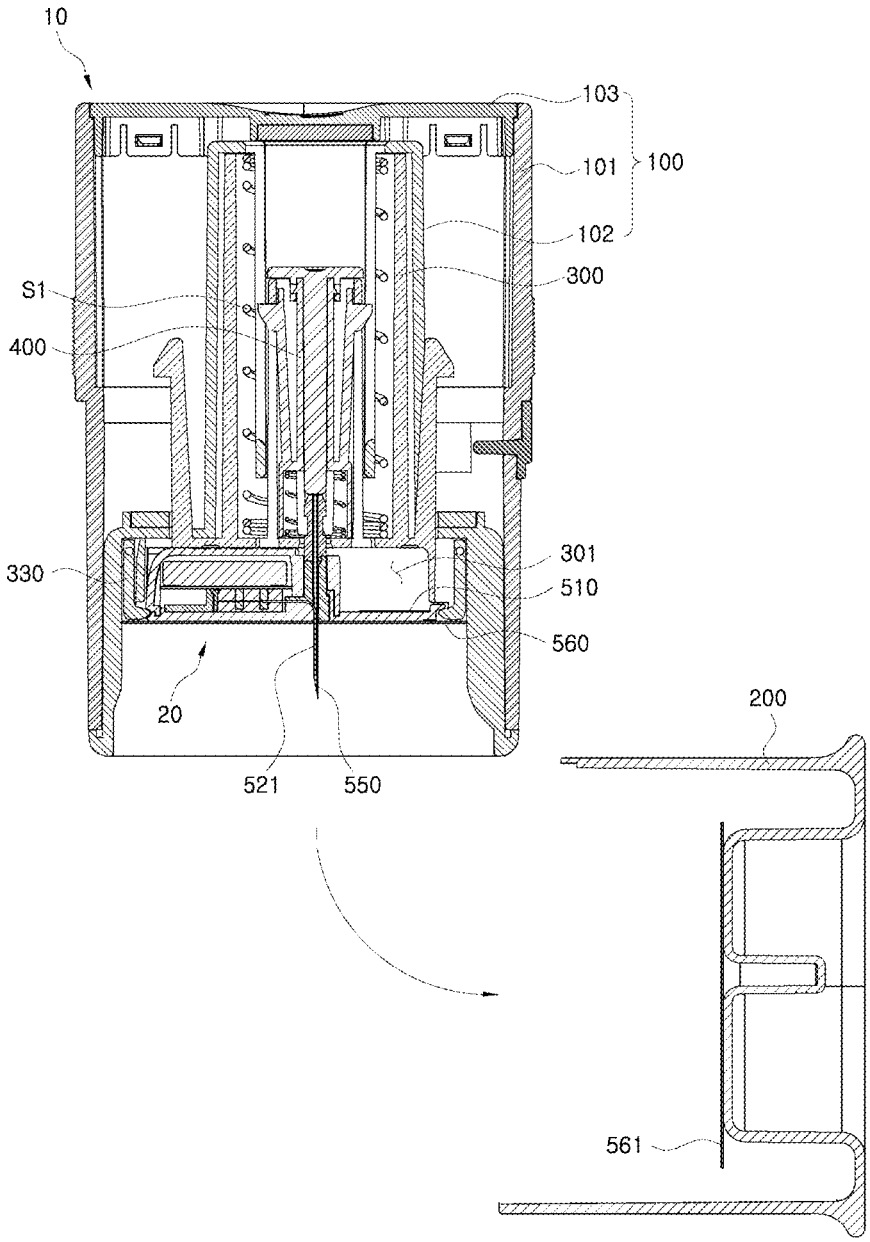


FIG. 22A

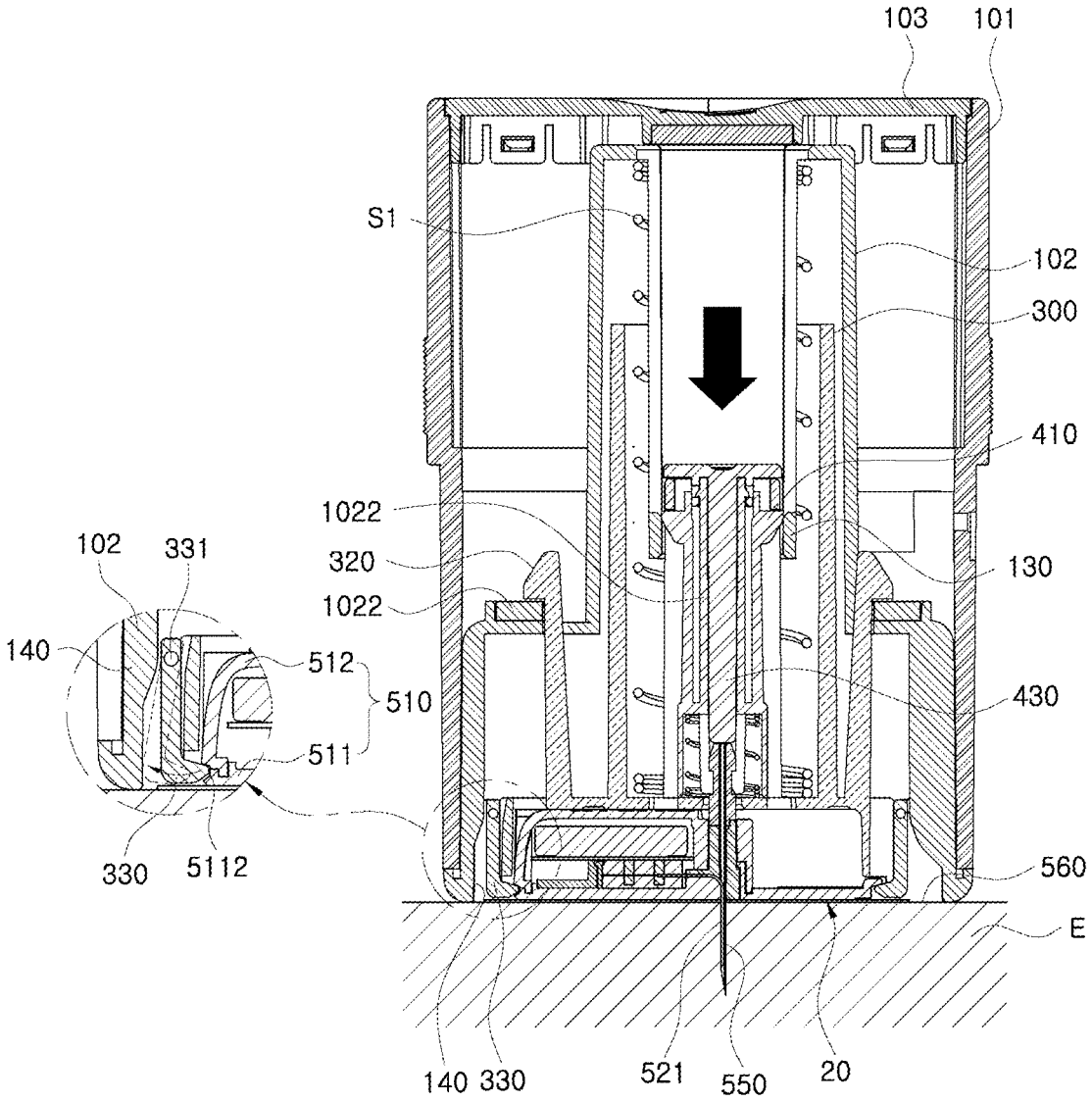

103
101
S1
102
300
410
1022
320
1022
130
102
331
140
512
510
511
430
330
5112
560
E
140
330
521
550
20

FIG. 22B

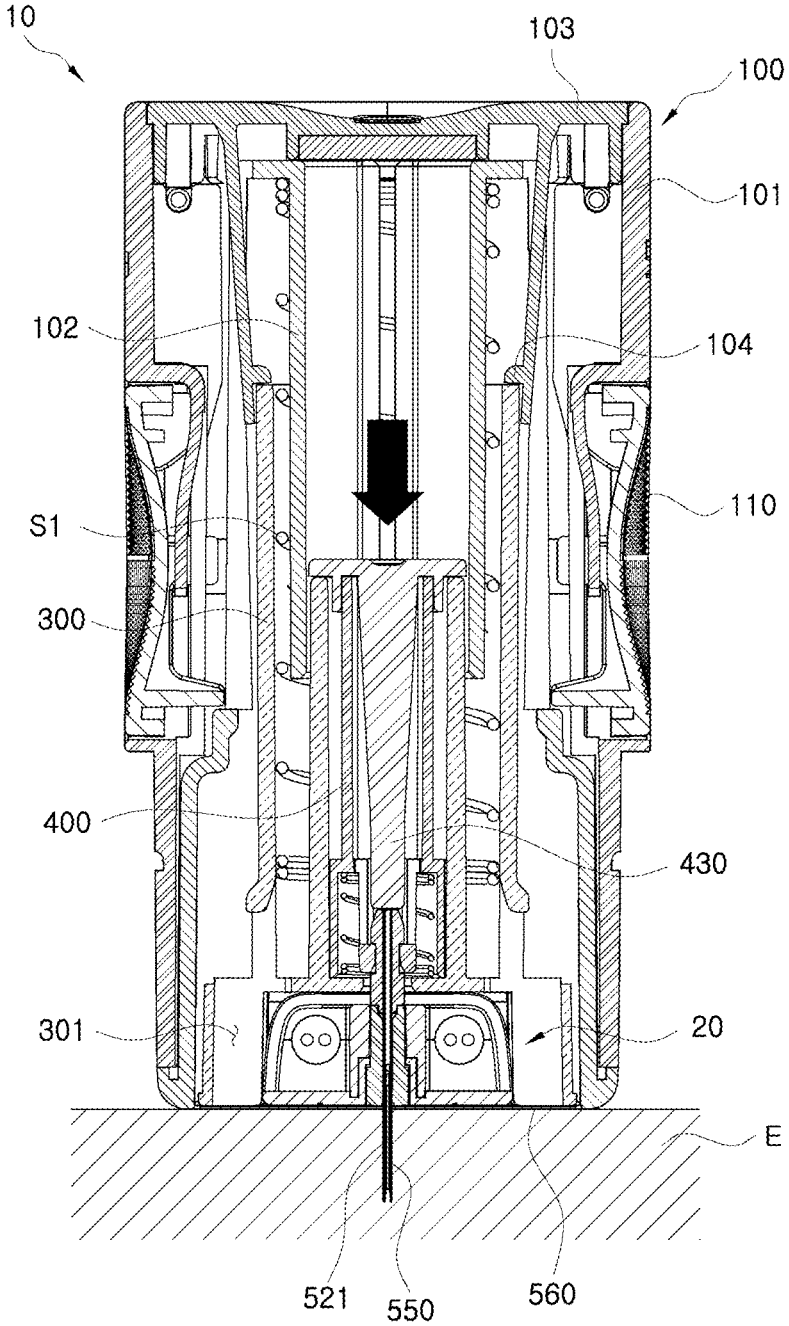


FIG. 23

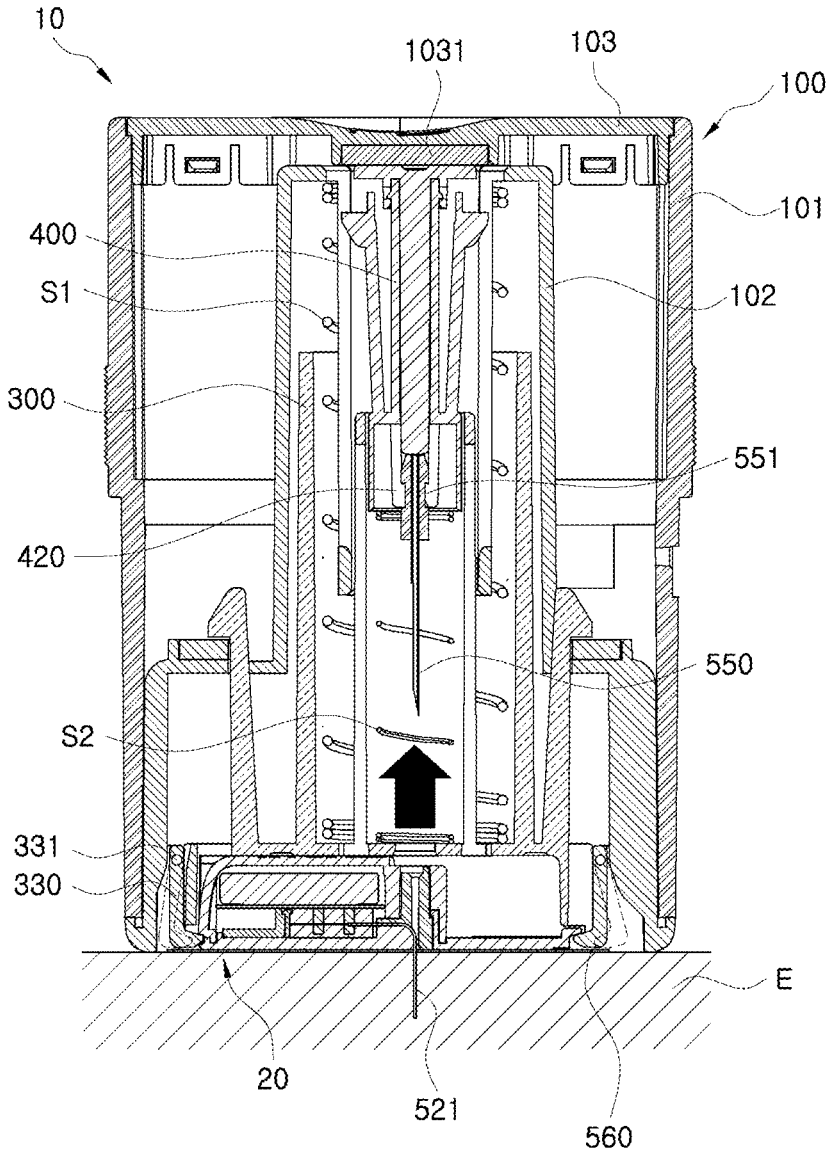
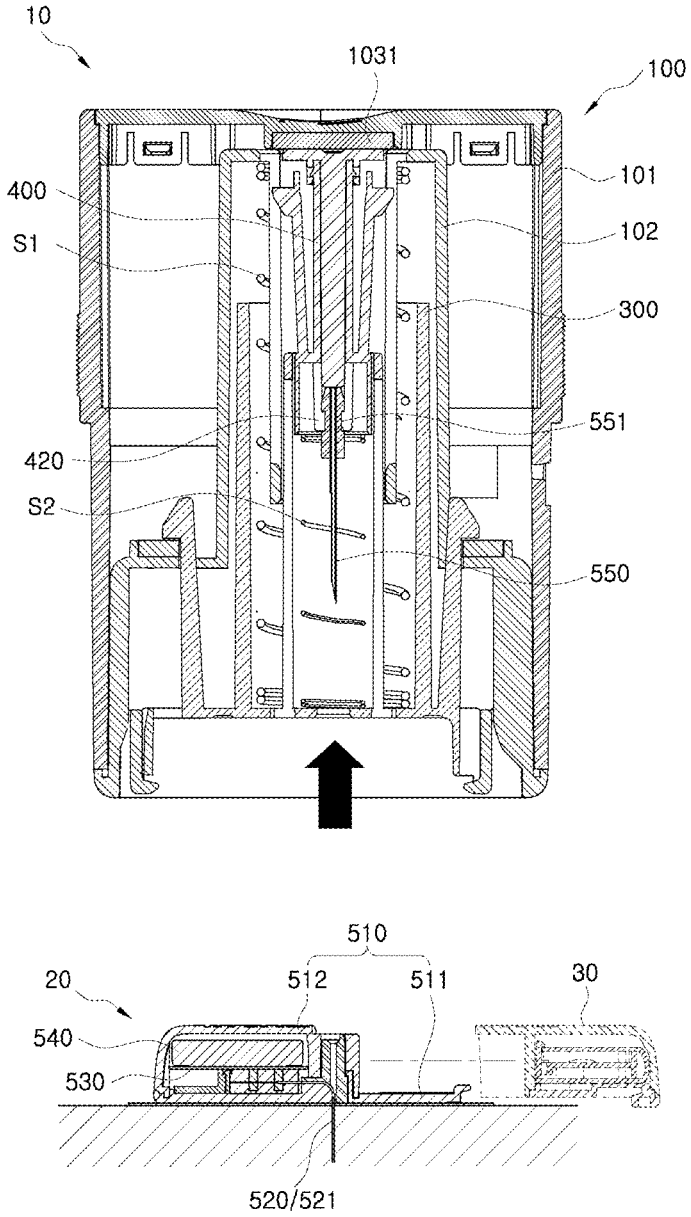

10
1031
103
100
101
400
S1
102
300
551
420
550
S2
331
330
E
20
521
560

FIG. 24


10
1031
100
101
400
102
S1
300
551
420
S2
550
510
20
512
511
30
540
530
520/521

SENSOR APPLICATOR ASSEMBLY FOR CONTINUOUS GLUCOSE MONITORING SYSTEM

TECHNICAL FIELD

[0001] The present disclosure relates to a sensor applicator assembly for a continuous glucose monitoring system. More particularly, the present disclosure relates to a sensor applicator assembly for a continuous glucose monitoring system, in which the sensor applicator assembly is fabricated, with a sensor module being preinstalled in an applicator, so that a user can attach the sensor module to the skin by simply operating the applicator. Additional tasks of the user for attaching the sensor module to the skin can be minimized, thereby allowing the sensor applicator assembly to be more conveniently used. In addition, a battery is provided as a built-in component of the sensor module and a separate transmitter is connected to the sensor module to receive power from the sensor module, so that the transmitter can be used semi-permanently, which is economical. In addition, the sensor module and the applicator are provided to be disposable so as to be used accurately and safely, thereby allowing safe use and convenient maintenance.

BACKGROUND ART

[0002] Diabetes or diabetes mellitus is a chronic medical condition that is common in modern people. In the Republic of Korea, it affects 2 million people, about 5% of the total population.

[0003] Diabetes is caused from the absolute deficiency or relative insufficiency of insulin produced by the pancreas, due to various causes such as obesity, stress, poor eating habits, inherited hereditary factors, in which glucose balance in the blood may be disturbed, thereby resulting in a high blood sugar level.

[0004] The blood usually contains a certain concentration of glucose, and tissue cells gain energy from the glucose.

[0005] However, when the content of glucose is increased excessively, it is not properly stored in the liver, muscle, or adipose tissue and accumulates in the blood. As a result, patients with diabetes maintain a much higher blood glucose level than other people. Excessive blood glucose passes through the tissues and is discharged into the urine, resulting in deficiency of glucose, which is absolutely necessary for all tissues of the body, thereby causing abnormalities in respective body tissues.

[0006] Diabetes mellitus is characterized by substantial absence of subjective symptoms at the beginning of the condition. When diabetes mellitus progresses, diabetes-specific symptoms such as diarrhea, polyuria, weight loss, general anxiety, skin itchiness, and scarring of the hands and feet are present. Further progression of diabetes leads to complications such as visual disturbances, hypertension, kidney disease, paralysis, periodontal disease, muscle spasms and neuralgia, as well as gangrene.

[0007] Systematic blood glucose measurement and treatment should be performed to diagnose diabetes beforehand and manage the condition to prevent the progression of diabetes into complications associated therewith.

[0008] For people with diabetes or people having higher than normal blood glucose, even though diabetes has not yet developed, medical device manufacturers offer a variety of blood glucose meters to measure blood glucose levels at home.

[0009] Glucose monitoring systems are categorized on the basis of a method of measuring a blood glucose level once by a user collecting blood from a fingertip and a method of continuously measuring blood glucose levels by attaching a glucose monitoring system to the belly or an arm of a user.

[0010] Diabetics generally traverse between hyperglycemia and hypoglycemia. An emergency may occur in hypoglycemic conditions, in which diabetics may become unconscious or die if a hypoglycemic condition lasts for an extended period of time without the supply of sugar. Accordingly, rapid discovery of a hypoglycemic condition is critically important for diabetics. However, invasive glucose monitoring systems intermittently measuring glucose by collecting blood have limited ability to accurately measure blood glucose levels.

[0011] Recently, to overcome such a drawback, continuous glucose monitoring systems (CGMSs) have been developed. Such a CGMS is inserted into the body to measure a blood glucose level every few minutes. In this manner, the treatment of diabetics and measures in response to an emergency can be easily undertaken.

[0012] In addition, in an invasive glucose monitoring system, a diabetic performs glucose measurement by collecting blood by pricking a pain-sensitive fingertip with a needle. Therefore, a blood collecting process may cause pain and aversion to measurement. To minimize such pain and aversion to measurement, research and development of CGMSs have been undertaken. In such a CGMS, glucose is continuously measured by inserting a needle-shaped sensor into a portion of the human body, such as the belly or an arm, which is less pain sensitive. Furthermore, research and development of non-invasive glucose monitoring systems for measuring glucose without collecting blood have been actively undertaken.

[0013] Regarding non-invasive glucose monitoring systems, a variety of methods of measuring glucose without collecting blood have been studied over the past 40 years. Such methods may include electrical methods, exhalation measurement methods, and the like. Cygnus (Redwoo City, Calif., USA) has developed and launched the Glucowatch® G2 Biographer, a watch-shaped glucose monitoring device, using reverse iontophoresis. However, the distribution of this device was stopped in 2007, because of problems, such as skin irritation, measurement approval, and a device malfunctioning caused by excessive sweating. Although a variety of non-invasive glucose monitoring techniques have been introduced and reported to date, there have been no practical uses due to low levels of accuracy thereof.

[0014] A continuous glucose monitoring system includes: a sensor module attached to the skin of a human body to measure a blood glucose level by extracting body fluid, a transmitter transmitting the blood glucose level measured by the sensor module to a terminal, the terminal outputting the received blood glucose level, and the like. The sensor module includes, for example, a needle-shaped sensor probe for insertion into subcutaneous fat to extract interstitial fluid. A separate applicator for attaching the sensor module to the body is used.

[0015] Such continuous glucose monitoring systems are fabricated to have a wide variety of shapes depending on the manufacturer thereof, and are used in a variety of methods.

However, in majority continuous glucose monitoring systems fabricated and distributed, a disposable sensor module is attached to the body using an applicator. A user should perform a multistage process to operate an applicator to attach a disposable sensor module to the body. After the sensor module is attached to the skin, the user should perform a variety of follow-up procedures by him or herself, such as a procedure of withdrawing a needle.

[0016] For example, a variety of procedures that the user should perform may include: unpacking the disposable sensor module, accurately inserting the disposable sensor module into the applicator, operating and inserting the applicator into the skin, with the sensor module being inserted into the applicator, withdrawing the needle of the sensor module from the skin using a separate device by him or herself after the insertion of the sensor module into the skin, and the like.

[0017] Accordingly, the process for measuring glucose using a continuous glucose monitoring system is significantly difficult and inconvenient, which are problematic. In addition, a transmitter used to transmit information regarding the sensor module is disposable together with the sensor module, although the transmitter is relatively expensive. Accordingly, there is another problem in that this solution is significantly inefficient in economic and environmental aspects.

DISCLOSURE

Technical Problem

[0018] Accordingly, the present disclosure has been made in consideration of the above-described problems occurring in the related art, and the present disclosure proposes a sensor applicator assembly for a continuous glucose monitoring system, in which the sensor applicator assembly is fabricated, with a sensor module being preinstalled in an applicator, so that a user can attach the sensor module to the skin by simply operating the applicator. Additional tasks of the user for attaching the sensor module to the skin can be minimized, thereby allowing the sensor applicator assembly to be more conveniently used.

[0019] Also proposed is a sensor applicator assembly for a continuous glucose monitoring system, in which a battery is provided as a built-in component of the sensor module and a separate transmitter is connected to the sensor module to receive power from the sensor module, so that the transmitter can be used semi-permanently, which is economical. In addition, the sensor module and the applicator are provided to be disposable so as to be used accurately and safely, thereby allowing safe use and convenient maintenance.

Technical Solution

[0020] The present disclosure provides a sensor applicator assembly for a continuous glucose monitoring system, the sensor applicator assembly being assembled as a single unitary product in which a sensor module periodically measuring a blood glucose level is preinstalled in an applicator, such that the sensor module is ejected by an operation of the applicator to be attached to a human body. A separate protective cap may be detachably coupled to the applicator to block the sensor module, preinstalled in the applicator, from being exposed externally, and adhesive tape and a release paper may be attached to a body contact surface of the sensor module to enable the sensor module to be attached to the human body, the release paper of the adhesive tape being detached and removed from the adhesive tape together with the protective cap while the protective cap is being detached from the applicator.

[0021] Here, the protective cap may include: an outer cover coupled to one end portion of the applicator while surrounding an outer circumferential surface of the applicator; an extension extending from one end of the outer cover in a direction of an inner center of the applicator; and an inner support extending upward from one end of the extension to support the body contact surface of the sensor module inserted into the applicator.

[0022] In addition, the adhesive tape and the release paper may be disposed between the body contact surface of the sensor module, and the release paper is attached to a top surface of the inner support of the protective cap coupled to the applicator, such that the release paper is detached and removed from the adhesive tape together with the protective cap while the protective cap is being detached from the applicator.

[0023] In addition, a separate adhesive member may be bonded to an exposed surface of the release paper, such that the release paper is attached to the top surface of the inner support of the protective cap.

[0024] In addition, two parallel cutting lines having the same width and size as those of the adhesive member may be provided in portions of the release paper.

[0025] In addition, the protective cap may be provided with a locking member to prevent the protective cap, coupled to the applicator, from being detached from the applicator. The locking member may be configured to be locked or unlocked by a user's manipulation.

[0026] In addition, the applicator may be provided with a locking catch recess. The locking member may include: a locking lever pivotably coupled to one side of the protective cap; and a locking catch protrusion provided on one end of the locking lever to be inserted into and engaged with the locking catch recess. The locking lever may be elastically supported in a direction in which the locking catch protrusion is inserted into and engaged with the locking catch recess.

Advantageous Effects

[0027] According to the present disclosure, the sensor applicator assembly is fabricated, with the sensor module being preinstalled in the applicator, so that a user can attach the sensor module to the skin by simply operating the applicator. Additional tasks of the user for attaching the sensor module to the skin can be minimized, thereby allowing the sensor applicator assembly to be more conveniently used.

[0028] In addition, a battery is provided as a built-in component of the sensor module and the separate transmitter is connected to the sensor module to receive power from the sensor module, so that the transmitter can be used semi-permanently, which is economical. In addition, the sensor module and the applicator are provided to be disposable so as to be used accurately and safely, thereby allowing safe use and convenient maintenance.

[0029] In addition, at the moment that the sensor module is attached to the human body by the operation of the applicator, the needle is automatically removed. Accordingly, it is possible to rapidly remove the needle without pain

without causing the human body to be injured during the removal of the needle, thereby further improving the convenience of use.

[0030] In addition, a release paper is removed from the sensor module while a protective cap is being detached, so that the sensor module can be attached to the human body with no other additional tasks, except for the operation of detaching the protective cap.

[0031] In addition, since the applicator cannot be reused after having been operated, it is possible to prevent a user from using the applicator improperly, thereby enabling the applicator to be used more safely.

DESCRIPTION OF DRAWINGS

[0032] FIG. **1** is a perspective view schematically illustrating an assembled configuration of a sensor applicator assembly for a continuous glucose monitoring system according to embodiments of the disclosure;

[0033] FIG. **2** is a perspective view schematically illustrating a configuration of a sensor module according to embodiments of the disclosure;

[0034] FIG. **3** is a perspective view illustrating an operation of attaching a transmitter to the sensor module according to embodiments of the disclosure;

[0035] FIG. **4** is an exploded perspective view schematically illustrating the sensor applicator assembly for a continuous glucose monitoring system according to embodiments of the disclosure;

[0036] FIG. **5** is a cross-sectional view taken along line A-A in FIG. **1**;

[0037] FIG. **6** is a cross-sectional view taken along line B-B in FIG. **1**;

[0038] FIG. **7** is a perspective view schematically illustrating a configuration of the protective cap according to embodiments of the disclosure;

[0039] FIGS. **8**A and **8**B are views illustrating a process of removing the protective cap according to embodiments of the disclosure;

[0040] FIGS. **9**A and **9**B are views illustrating a process of removing the release paper together with the protective cap according to embodiments of the disclosure;

[0041] FIG. **10** is an exploded perspective view schematically illustrating a specific configuration of the sensor module according to embodiments of the disclosure;

[0042] FIG. **11** is an exploded perspective view schematically illustrating a configuration of the sensor of the sensor module according to embodiments of the disclosure;

[0043] FIG. **12** is a cross-sectional view schematically illustrating an internal configuration of the sensor module according to embodiments of the disclosure;

[0044] FIG. **13** is a view illustrating a coupling-guiding state of the sensor and the needle of the sensor module

[0045] FIGS. **14** and **15** are perspective views schematically illustrating configurations of the press button and the safety locking device according to embodiments of the disclosure;

[0046] FIGS. **16**A and **16**B are views illustrating a coupling structure of the safety locking device and the protective cap according to embodiments of the disclosure;

[0047] FIG. **17** is a view illustrating a configuration of the sensor fixing hooks of the plunger body according to embodiments of the disclosure;

[0048] FIGS. **18**A and **18**B are views illustrating a separation structure of the applicator and the sensor module according to embodiments of the disclosure;

[0049] FIGS. **19**A and **19**B are views illustrating a reuse prevention structure of the applicator according to embodiments of the disclosure;

[0050] FIG. **20** is a perspective view schematically illustrating a configuration of the anti-return hooks of the applicator according to embodiments of the disclosure; and

[0051] FIGS. **21** to **24** are views sequentially illustrating the use of the sensor applicator assembly for a continuous glucose monitoring system according to embodiments of the disclosure, in a stepwise manner.

MODE FOR INVENTION

[0052] Hereinafter, embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. Throughout this document, reference should be made to the drawings, in which the same reference numerals and symbols will be used to designate the same or like components. In the following description of the present disclosure, detailed descriptions of known functions and components incorporated herein will be omitted in the case that the subject matter of the present disclosure may be rendered unclear thereby.

[0053] FIG. **1** is a perspective view schematically illustrating an assembled configuration of a sensor applicator assembly for a continuous glucose monitoring system according to embodiments of the disclosure, FIG. **2** is a perspective view schematically illustrating a configuration of a sensor module according to embodiments of the disclosure, FIG. **3** is a perspective view illustrating an operation of attaching a transmitter to the sensor module according to embodiments of the disclosure, FIG. **4** is an exploded perspective view schematically illustrating the sensor applicator assembly for a continuous glucose monitoring system according to embodiments of the disclosure, FIG. **5** is a cross-sectional view taken along line A-A in FIG. **1**, and FIG. **6** is a cross-sectional view taken along line B-B in FIG. **1**.

[0054] The sensor applicator assembly **1** for a continuous glucose monitoring system according to embodiments of the disclosure is an assembly fabricated as a single unitary product by fitting a sensor module **20** and an applicator **10** together. The sensor applicator assembly **1** has a structure to be use thereof to be very simple, thereby minimizing additional tasks of a user to use the continuous glucose monitoring system.

[0055] The sensor module **20** is configured to be attachable to a portion of the human body to extract body fluid and periodically measure a blood glucose level, and allows a separate transmitter **30** to be connected thereto to transmit a glucose measurement result to an external device, such as a mobile device (not shown).

[0056] The applicator **10** is configured such that the sensor module **20** is fixedly coupled to an inner portion thereof, and operates to eject the sensor module **20** in response to a user's manipulation.

[0057] Here, fabrication and assembly processes are performed, with the sensor module **20** being preinstalled in the applicator **10**. When the applicator **10** is operated by the user's manipulation, the sensor module **20** is moved in an ejecting direction to be attached to the portion of the human body.

[0058] That is, the sensor applicator assembly **1** according to embodiments of the disclosure is assembled and fabricated in a fabrication process, with the sensor module **20** being preinstalled in the applicator, such that the sensor module **20** is attachable to the skin only by the operation of the applicator **10**. The sensor applicator assembly **1** is provided to a user in this state. Accordingly, the user can attach the sensor module **20** to the skin by simply operating the applicator **10** without an additional operation for attaching the sensor module **20** to the skin. After the sensor module **20** is attached to the skin, the separate transmitter **30** is connected to the sensor module **20**, so that a glucose measurement result can be periodically output from a terminal of the continuous glucose monitoring system.

[0059] When the lifetime of the sensor module **20** has ended after having been used for about one (1) week while attached to the human body, a new sensor module **20** must be attached to the human body. Here, the sensor module **20** and the applicator **10** are fabricated and used to be disposable, while the transmitter **30** is continuously used as a separate product. That is, since the sensor module **20** is distributed as being preinstalled in the applicator **10** and attachable to the human body, an additional operation of, for example, inserting the sensor module **20** into the applicator **10** by the user is unnecessary. The user attaches the sensor module **20** to the body by simply operating the applicator **10**. After the sensor module **20** and the applicator **10** have been used in this manner, the sensor module **20** and the applicator **10** cannot be reused. A new sensor module **20** is attached to the body using a new sensor applicator assembly **1**. Here, the transmitter **30** may be configured to be reusable as a separate product instead of being disposable.

[0060] In a typical continuous glucose monitoring system of the related art, a sensor module separately packed is unpacked and then is accurately inserted into an applicator. After the insertion, the applicator is operated to attach the sensor module to the skin. The operation of accurately insert the sensor module into the applicator is bothering and difficult. Children or older persons may contaminate the sensor module during this operation, thereby lowering the accuracy of measurement, which is problematic.

[0061] According to embodiments of the disclosure, the sensor module **20** is preinstalled in the applicator **10** in the fabrication process, so that the applicator **10** is distributed with the sensor module **20** preinstalled therein. The user's operations of, for example, unpacking the sensor module **20** and inserting the sensor module **20** into the applicator **10** may be omitted. It is possible to attach the sensor module **20** to the skin by simply manipulating the applicator **10**. Accordingly, the usability of the sensor module **20** can be significantly improved, and in particular, the contamination of the sensor module **20** or the like can be prevented, thereby improving the accuracy of glucose measurement.

[0062] Since the sensor module **20** is preinstalled in the applicator **10** in the fabrication process as described above, the sensor module **20** and the applicator **10** may be provided to be disposable so as not to be reusable. To provide such a disposable structure, the applicator **10** according to embodiments of the disclosure is configured such that the sensor module **20** cannot be reinserted into the applicator **10** after the applicator **10** is operated once to eject the sensor module **20** therefrom.

[0063] That is, the applicator **10** is configured to have one open side, through which the sensor module **20** is ejected to the outside. The applicator **10** may be configured such that, once the applicator **10** has ejected the sensor module **20** by an initial single operation, another sensor module **20** is prevented from being inserted into the applicator **10**, so that the user cannot insert the sensor module **20** into the applicator **10**.

[0064] In addition, a separate protective cap **200** may be detachably coupled to the applicator **10** to prevent the sensor module **20**, preinstalled in the applicator **10**, from being exposed externally. The protective cap **200** may be configured such that the user cannot attach the sensor module **20** to the human body by operating the applicator **10** unless the protective cap **200** is detached.

[0065] Here, adhesive tape **560** is attached to a body contact surface of the sensor module **20**, such that sensor module **20** can be attached to the human body. A release paper **561** is attached to the body contact surface of the adhesive tape **560** to protect the adhesive tape **560**. The release paper **561** of the adhesive tape **560** may be detached and removed from the adhesive tape **560** while the protective cap **200** is being detached from the applicator **10**.

[0066] For example, the release paper **561** may be configured such that one portion thereof is bonded to the protective cap **200**. Thus, when the user detaches the protective cap **200** from the applicator **10**, the release paper **561** can be detached and removed from the adhesive tape **560** along with the protective cap **200**. Accordingly, when the user detaches the protective cap **200**, the release paper **561** is removed from the adhesive tape **560**. In this state, it is possible to attach the sensor module **20** to the human body by operating the applicator **10**.

[0067] In addition, the applicator **10** may be configured such that, in a state in which the sensor module **20** is preinstalled in the applicator **10**, the sensor module **20** is fixedly coupled to the applicator **10**, and in a state in which the sensor module **20** is ejected (i.e. is moved outwardly by ejection), the sensor module **20** is decoupled from the applicator **10**. Thus, in a state in which the sensor module **20** is inserted into and coupled to the applicator **10**, the sensor module **20** remains in a fixed position. In a state in which the sensor module **20** is ejected to be attached to the skin by operating the applicator **10**, the sensor module **20** is decoupled from the applicator **10**. In this situation, when the applicator **10** is detached from the skin, the applicator **10** and the sensor module **20** are detached from each other, while the sensor module **20** remains attached to the skin.

[0068] Next, respective specific configurations will be described in more detail.

[0069] First, the protective cap **200** is detachably coupled to the open side of the applicator **10** to prevent the sensor module **20**, preinstalled in the applicator **10**, from being exposed externally. The protective cap **200** is provided with locking members **210** to prevent the protective cap **200**, coupled to the applicator **10**, from being detached from the applicator **10**, as illustrated in FIG. **7**. The locking members **210** are configured to be locked or unlocked by the user's manipulation.

[0070] Each of the locking members **210** includes a locking lever **211** pivotably coupled to one side of the protective cap **200** and a locking catch protrusion **213** provided on one end of the locking lever **211**. The locking lever **211** may have an elastic hinge shaft **212** provided on an intermediate portion thereof, such that both end portions of the locking lever **211** elastically pivot about the elastic hinge shaft **212**.

In addition, locking catch recesses **1011** corresponding to the shape of the locking members **210** may be formed in outer circumferential portions of the applicator **10**, such that the locking catch protrusion **213** may be fitted into and engaged with the locking catch recesses **1011**.

[0071] Here, the locking lever **211** may be configured to be elastically supported by the elastic hinge shaft **212** in a direction in which the locking catch protrusion **213** is fitted into and engaged with the locking catch recesses **1011**.

[0072] According to this configuration, the protective cap **200** remains coupled to the applicator **10** unless the user presses the bottom end portion of the locking lever **211**, as illustrated in FIG. **8***a*. In a state in which the locking catch protrusion **213** is disengaged from the locking catch recesses **1011** by pressing the locking lever **211**, the protective cap **200** can be detached and removed from the applicator **10**, as illustrated in FIG. **8***b*.

[0073] The protective cap **200** includes an outer cover **201**, an extension **202**, and an inner support **203**. The outer cover **201** is coupled to one end portion of the applicator **10**, and surrounds, while being in contact with, an outer circumferential surface of the applicator **10**. The extension **202** extends from one end of the outer cover **201** in the direction of the inner center of the applicator **10**. The inner support **203** extends upward from the extension **202** to support the body contact surface of the sensor module **20** preinstalled in the applicator **10**. Here, a sensor protector **204** may protrude downward from a local portion the central portion of the inner support **203** to surround a sensor probe **521** and a needle **550** protruding downward from the body contact surface of the sensor module **20**.

[0074] Accordingly, the protective cap **200** not only blocks the sensor module **20**, preinstalled in the applicator **10**, from being exposed externally, but also supports the sensor module **20**. The protective cap **200** generally improves the structural stability of the sensor applicator assembly.

[0075] In addition, as described above, the adhesive tape **560** and the release paper **561** are attached to the body contact surface of the sensor module **20**. In the process of detaching the protective cap **200** from the applicator **10**, the release paper **561** of the adhesive tape **560** is detached and removed from the adhesive tape **560** along with the protective cap **200**.

[0076] Here, the release paper **561** may be attached to the top surface of the inner support **203** of the protective cap **200**, and may be attached to the inner support **203** of the protective cap **200** via a separate adhesive member **562**. That is, as illustrated in FIG. **9***a*, a separate adhesive member **562** is bonded to a bottom surface portion of the release paper **561**. The adhesive member **562** is located between the top surface of the inner support **203** of the protective cap **200** and the release paper **561**, such that the bottom surface of the adhesive member **562** is bonded to the top surface of the inner support **203**. The bonding force of the adhesive member **562** is set to be greater than the bonding force between the release paper **561** and the adhesive tape **560**. Thus, when the protective cap **200** is detached from the applicator **10**, the release paper **561** bonded to the inner support **203** of the protective cap **200** via the adhesive member **562** is detached from the inner support **203** along with the protective cap **200**. In this manner, the release paper **561** is detached and removed from the adhesive tape **560**.

[0077] Here, two parallel cutting lines (not shown) having the same width and size as those of the adhesive member **562** may be formed in portions of the release paper **561**. Consequently, as illustrated in FIG. **9***b*, first, in the process of detaching the protective cap **200**, the release paper **561** is detached from the adhesive tape **560** along the cutting lines along with the adhesive member **562**. Afterwards, in response to continued detaching of the protective cap **200**, i.e. continued downward movement of the protective cap **200** respect to the direction illustrated in FIG. **9***b*, the release paper **561** in portions other than the cutting line is pulled, thereby being detached and removed from the adhesive tape **560**. Due to this release paper detaching process, the operation of detaching and removing the release paper **561** can be more easily and reliably performed.

[0078] In addition, the above-described locking levers **211** of the protective cap **200** may be provided on the central portions of the outer cover **201**. For example, the locking lever **211** may be provided such that the locking lever **211** is formed by cutting a portion of the outer cover **201** and the elastic hinge shaft **212** is formed on a portion cutting lines to be connected to the outer cover **201**.

[0079] The sensor module **20** includes a pod **510**, a sensor **520**, a printed circuit board (PCB) **530**, and a battery **540**.

[0080] The adhesive tape **560** is attached to the bottom end surface of the pod **510**, such that the sensor module **20** can be ejected by the applicator **10** so as to be attached to the human body. The pod **510** has a connector terminal **513** to which the transmitter **30** can be connected. The pod **510** may include a flat plate-shaped pod base **511** and a case-shaped pod body **512**. The adhesive tape **560** is attached to the bottom end surface of the pod base **511**. The pod body **512** is provided on a portion of the top surface of the pod base **511** to surround a portion of a space above the pod base **511**. The pod body **512** is located on a top surface portion of the pod base **511**. The sensor **520**, the PCB **530**, the battery **540**, and the like, are disposed in the internal space of the pod body **512**. The pod **510** is attached to the human body by the operation of the applicator **10**. The pod base **511** is attached to the human body via the adhesive tape **560**. Afterwards, the separate transmitter **30** is seated on and coupled to the top surface of the pod base **511** so as to be connected to the connector terminal **513** of the pod body **512**.

[0081] The sensor **520** is disposed within the internal space of the pod **510** such that one end portion of the sensor **520** protrudes downward from the pod **510**. As the pod **510** is ejected, the one end of the sensor **520** is inserted into the body to extract blood and measure a blood glucose level. The sensor **520** includes a sensor probe **521** having one end portion protruding downward from the bottom end surface of the pod base **511**, the sensor probe **521** being able to be inserted into the body to extract blood.

[0082] The PCB **530** is disposed within the internal space of the pod **510**, and is electrically connected to the other end portion of the sensor probe **521**. One end portion of the sensor probe **521** is inserted into the skin to react with glucose in the body fluid. Here, current change information of the sensor probe **521** occurring depending on the glucose concentration of blood is electrically transferred to the PCB **530**. The PCB **530** has a terminal connector point **532** to be connected to the connector terminal **513** provided on the pod **510**.

[0083] The battery **540** is disposed on the PCB **530** within the internal space of the pod **510** to supply power to the

sensor **520** or the like. The PCB **530** includes a battery bracket **531** on which the battery **540** can be mounted and supported. Power supplied by the battery **540** is supplied to the connector terminal **513** via the PCB **530**. In a state in which the transmitter **30** is connected to the connector terminal **513** of the pod **510**, the power is supplied to the transmitter **30** via the connector terminal **513**. That is, the transmitter **30** operates by receiving power from the battery **540** disposed inside of the sensor module **20**. In addition, the current change information obtained using the sensor **520** is also transferred to the transmitter **30** via the PCB **530** and the connector terminal **513**, and then, is transmitted to a user terminal via the transmitter **30**. In addition, since the transmitter **30** operates by receiving power from the battery **540** of the sensor module **20**, no separate battery is required to be disposed inside of the transmitter **30**. Accordingly, the replacement of the transmitter **30** due to the power exhaustion of the battery is not required, and the transmitter **30** can be used semi-permanently.

[0084] At the moment that the pod **510** is attached to the human body after having been moved in the ejecting direction in response to the operation of the applicator **10**, one end portion of the sensor **520** is inserted into the body. The sensor **520** generates a different current value depending on the glucose concentration in blood through reaction with the body fluid. Such current change information is transferred to the PCB **530**, is applied to the transmitter **30** via the PCB **530** and the connector terminal **513**, and is transmitted to the user terminal via the transmitter **30**.

[0085] In addition, the sensor module **20** may further include the separate needle **550** to facilitate the insertion of the sensor probe **521** into the body. The needle **550** is detachably coupled to the pod **510**. The needle **550** is configured to be inserted into the body together with the sensor probe **521** while surrounding one end portion of the sensor probe **521** in response to the pod **510** being ejected, so that one end portion of the sensor probe **521** is reliably inserted into the body.

[0086] As illustrated in FIG. **2**, the needle **550** is detachably disposed in the pod **510** while extending through the pod **510** in the top-bottom direction. The needle **550** has the shape of a hollow pipe surrounding the sensor probe **521**, and a needle head **551** is provided on the top end portion of the needle **550**. When the pod **510** is moved in the ejecting direction by the applicator **10**, the needle **550** is inserted into the body prior to the sensor probe **521** to assist in reliable insertion of the sensor probe **521** into the skin. The needle head **551** has a coupling recess **552** that can be coupled to the applicator **10** when withdrawing the needle **550** from the skin.

[0087] At the moment that the ejection movement of the pod **510** is completed, the applicator **10** is operable to withdraw and remove the needle **550** from the body. Accordingly, in a state in which the pod **510** is attached to the human body, the sensor probe **521** remains inserted into the body, but as illustrated in FIG. **2**(*b*), the needle **550** is withdrawn and removed. In this state, the transmitter **30** is coupled to the pod **510** to be connected to the connector terminal **513**, as illustrated in FIGS. **3**(*a*) and (*b*).

[0088] Describing the configuration of the sensor **520** in more detail, the sensor **520** includes the sensor probe **521**, a sensor housing **522**, a rubber block **523**, and an elastic contact **524**. The sensor probe **521** is configured to be inserted into the body to extract blood, with one end portion **5211** protruding downward from the bottom end surface of the pod base **511**, and the other end portion **5212** being disposed in the internal space of the pod **510**. The sensor housing **522** is configured to surround a portion of the sensor probe **521** to support the sensor probe **521**. The rubber block **523** is coupled to the sensor housing **522**, such that the other end portion **5212** of the sensor probe **521** extends through the rubber block **523**. The elastic contact **524** is inserted into the rubber block **523**, such that the other end portion **5212** of the sensor probe **521** extends through the elastic contact **524**. One end portion of the elastic contact **524** is in elastic contact with the PCB **530**.

[0089] The sensor probe **521** is configured such that one end portion **5211** and the other end portion **5212** are bent perpendicularly from each other. The sensor housing **522** is provided with a probe passage **5221**, with the sensor probe **521** being inserted into and extending through the probe passage **5221**. The position of the sensor probe **521** is guided by the probe passage **5221**. A needle support **5222** protrudes upward from the top portion of the sensor housing **522**, such that the needle **550** is fitted to, while extending through, the needle support **5222**. The sensor housing **522** is provided with a rubber receptacle **5223** on one side of the needle support **5222**, such that the rubber block **523** is inserted into and accommodated in the rubber receptacle **5223**. A rubber fixing hook **5224** and sensor fixing hooks **5225** are provided on sidewalls of the rubber receptacle **5223**. The rubber fixing hook **5224** is engaged with the rubber block **523** to fix the rubber block **523**. The sensor fixing hooks **5225** cause the sensor housing **522** to be fitted into the pod **510** by engagement. A sensor housing receptacle **5111** is provided in the pod base **511** of the pod **510**. The sensor housing receptacle **5111** accommodates the sensor housing **522** inserted into and coupled to the sensor housing receptacle **5111**. The sensor fixing hooks **5225**, provided on the rubber receptacle **5223** of the sensor housing **522**, are configured to engage with the sensor housing receptacle **5111** of the pod base **511**.

[0090] The PCB **530** is disposed above the sensor **520**, and the battery **540** is mounted on the top surface of the PCB **530**. In the sensor probe **521** of the sensor **520**, one end portion **5211** is inserted into the skin, and the other end portion **5212** is coupled to, while extending through, the rubber block **523** and the elastic contact **524**. The elastic contact **524** is in electrical contact with the PCB **530**. Thus, the sensor probe **521** is electrically connected to the PCB **530** via the elastic contact **524**.

[0091] In addition, the needle **550** has the shape of a pipe surrounding an external space of the sensor probe **521**, and extends through the needle support **5222** of the sensor housing **522** in the top-bottom direction. The needle head **551** is provided on the top end portion of the needle **550**. Here, the sensor housing **522** and the needle head **551** may be provided with a guide recess **5226** and a guide protrusion **553** in a corresponding manner. The guide protrusion **553** may be inserted into the guide recess **5226** to guide a coupling position of the sensor housing **522** and the needle head **551**.

[0092] For example, as illustrated in FIG. **13**, the guide recess **5226** may be formed in the top end portion of the needle support **5222** of the sensor housing **522**, while the guide protrusion **553** may protrude from the bottom end portion of the needle head **551** to be inserted into the guide recess **5226**. Accordingly, the direction of the insertion of the needle head **551** and sensor housing **522** of the needle **550**

into the sensor housing **522** may be guided so that the needle **550** and the sensor probe **521** may be coupled to each other while being accurately aligned.

[0093] The applicator **10** includes a main container **100**, a plunger body **300**, and an elastic plunger spring S**1**. The main container **100** has a press button **110** mounted on a portion of the main container **100** to be press-manipulated by a user. The plunger body **300** is fixedly coupled to an internal position, i.e. a first position, of the main container **100**. In response to the press button **110** being manipulated, the plunger body **300** is decoupled from the first position to move linearly to a second position in an ejecting direction. The elastic plunger spring S**1** applies elastic force to the plunger body **300** so that the plunger body **300** moves linearly from the first position to the second position. The sensor module **20** is coupled to one end portion of the plunger body **300** to move from the first position to the second position, integrally with the plunger body **300**.

[0094] The main container **100** may be divided into an external container **101** and an internal container **102**. The press button **110** is mounted on the external container **101**. The internal container **102** is coupled to the interior of the external container **101** to guide the plunger body **300** along a linear movement path. In addition, the external container **101** may have the shape of a pipe, with a separate container cover **103** being coupled to the top end portion of the external container **101**. The container cover **103** may be provided with anti-return hooks **104**, as illustrated in FIGS. **4** and **5**, to prevent the plunger body **300** from returning to the first position after having moved linearly to the second position.

[0095] In addition, as illustrated in FIGS. **4** and **5**, a separate safety locking device **120** may be coupled to the external container **101** to prevent the press button **110** from being press-manipulated. The press button **110** can be press-manipulated after the safety locking device **120** is removed.

[0096] When a user erroneously manipulates the press button **110** by pressing it in a state in which the applicator **10** is not located in a proper position, the sensor module **20** located inside of the main container **100** is triggered and ejected. The safety locking device **120** can be mounted to prevent the sensor module **20** from being erroneously ejected, thereby enabling more reliable use.

[0097] The elastic plunger spring S**1** applies elastic force to the plunger body **300** to move linearly from the first position to the second position within the main container **100**. The plunger body **300** is provided with elastic hooks **310** that are elastically deformable. When the plunger body **300** is in the first position, the elastic hooks **310** may be engaged with the internal container **102** to be fixed in position. The internal container **102** is provided with fixing stepped portions **1021**, with which the elastic hooks **310** of the plunger body **300** are engaged in the first position.

[0098] When the press button **110** of the external container **101** is press-manipulated inwardly as illustrated in FIG. **5**, internal pressing protrusions **111** of the press button **110** press the elastic hooks **310** of the plunger body **300**. This disengages the elastic hooks **310** from the internal container **102**, so that the plunger body **300** is moved linearly to the second position by the elastic force of the elastic plunger spring S**1**. Here, as described above, it is not possible to press-manipulate the press button **110** unless the safety locking device **120** is removed.

[0099] In addition, the plunger body **300** may be provided with stopper protrusions **320** to limit a range of movement to the second position. In response to the movement of the plunger body **300** to the second position, the stopper protrusions **320** can limit the movement of the plunger body **300** by engaging with a portion of the internal container **102**. That is, the range of movement of the plunger body **300** is limited to the second position by the stopper protrusions **320**. The plunger body **300** is not ejected from the main container **100** beyond this range of movement.

[0100] Here, as illustrated in FIG. **6**, buffer members **1022** may be coupled to portions of the internal container **102**, with which the stopper protrusions **320** of the plunger body **300** engage. The buffer members **1022** can absorb impacts occurring when the moving plunger body **300** engages with the internal container **102**. The buffer members **1022** can minimize noise caused by the engagement of the moving plunger body **300** during the operation of the applicator and minimize reaction due to the collision of the plunger body **300**. Accordingly, it is possible to accurately insert the sensor probe **521** into the body.

[0101] In addition, a sensor receptacle **301** is provided on one end portion of the plunger body **300**. The sensor receptacle **301** accommodates the sensor module **20** inserted into the sensor receptacle **301**. The sensor module **20** is inserted into and accommodated in the sensor receptacle **301**, and moves linearly from the first position to the second position along with the plunger body **300**. Due to the linear movement to the second position, the sensor probe **521** and the needle **550** of the sensor module **20** are inserted into the body.

[0102] Here, sensor fixing hooks **330** are mounted on peripheral portions of the sensor receptacle **301**. The sensor fixing hooks **330** can engage with the sensor module **20**, inserted into the sensor receptacle **301**, to fix the sensor module **20**. The sensor fixing hooks **330** are coupled to the sensor module **20** such that each of the fixing hooks **330** is rotatable about a rotary shaft **331**. When the plunger body **300** is in the first position, the sensor fixing hooks **330** is pressed inwardly by the internal container **102** to engage with the sensor module **20**. When the plunger body **300** is in the second position, the sensor fixing hooks **330** are released from the pressed state, thereby disengaging from the sensor module **20**. In this regard, the internal container **102** is provided with a hook guide **140**, which will be described in more detail later.

[0103] In addition, as illustrated in FIG. **14**, the external container **101** is provided with a button guide opening **1012** into which the press button **110** is inserted. The button guide opening **1012** allows the inserted press button **110** to move when pressed. The pressing protrusions **111** are provided on the inner surface of the press button **110**. In response to the pressed movement of the press button **110** in the button guide opening **1012** (or as the press button **110** in the button guide opening **1012** moves when pressed), the pressing protrusions **111** can press the elastic hooks **310** of the plunger body **300**. The press button **110** is coupled to one end portion of the external container **101** via hinge rods **1112**, such that press button **110** can pivot in a predetermined range. The press button **110** is configured to move by pivoting when pressed. A separate elastic member **1013** may be provided in the button guide opening **1012** to enable an elastic return function in response to the press button **110** being press-manipulated.

[0104] The safety locking device **120** able to prevent the press-manipulation performed to the press button **110** is coupled to the external container **101**. As illustrated in FIGS. **14** and **15**, the safety locking device **120** is slid into the button guide opening **1012** in a direction perpendicular to the depth direction of the button guide opening **1012** to prevent the pressed movement of the press button **110**. Slide holes **1014** are provided in one portion of the external container **101**, such that the safety locking device **120** is slid into the button guide opening **1012** through the slide holes **1014**.

[0105] The safety locking device **120** includes anti-pressing rods **121** and an outer support **122**. The anti-pressing rods **121** are configured to be inserted into and withdrawn from the button guide opening **1012** by sliding. The outer support **122** extends from one end of each of the anti-pressing rods **121**, and is configured to surround an outer circumferential portion of the external container **101** in a state in which the anti-pressing rods **121** are inserted into the button guide opening **1012**. When the anti-pressing rods **121** are inserted into the button guide opening **1012**, the anti-pressing rods **121** are disposed to extend through the button guide opening **1012** in a direction perpendicular to the depth direction of the button guide opening **1012**. Accordingly, the pressed movement of the press button **110** in the depth direction of the button guide opening **1012** is restrained.

[0106] Gripping protrusions **123** may protrude outward from the outer support **122** of the safety locking device **120**, such that the user can hold the gripping protrusions **123** with a hand when the user intends to slide and withdraw the safety locking device **120**. A guide protrusion **124** may protrude from a side surface portion of the outer support **122**. During sliding insertion, the guide protrusion **124** may be fitted into, while extending through, the external container **101** to accurately guide the safety locking device **120** to the insertion position.

[0107] In addition, the safety locking device **120** may be configured so as not to be decoupled from the main container **100** unless the protective cap **200** is decoupled from the main container **100**. This is because, if the safety locking device **120** is decoupled and the press button **110** is pressed in a state in which the protective cap **200** is not detached, the sensor probe **521** may be damaged through collision with the protective cap **200**.

[0108] Accordingly, an engagement extension **125** may be provided on the outer support **122** of the safety locking device **120** to extend perpendicularly to the direction in which the anti-pressing rods **121** are slid. Accordingly, as the protective cap **200** is coupled to the external container **101** in a state in which the outer support **122** is coupled to the external container **101** while surrounding an outer surface portion of the external container **101**, the engagement extension **125** may engage with the protective cap **200**.

[0109] According to this structure, as illustrated in FIG. **16***a*, in a state in which the safety locking device **120** is slid into the external container **101**, if the protective cap **200** is not detached and removed, the engagement extension **125** of the safety locking device **120** cannot remain engaged with the top end portion of the protective cap **200**, so that the safety locking device **120** cannot be removed from the external container **101**. As illustrated in FIG. **16***b*, if the protective cap **200** is detached and removed, the engagement extension **125** of the safety locking device **120** is disengaged. Accordingly, it is possible to slide and withdraw the safety locking device **120** from the external container **101**, so that the safety locking device **120** is removed.

[0110] In addition, the applicator **10** is configured such that, in the first position in which the sensor module **20** is preinstalled therein, the sensor module **20** remains fixedly coupled to the sensor module **20**, and in the second position in which the sensor module **20** is ejected, the sensor module **20** is decoupled from the sensor module **20**.

[0111] As described above, the sensor fixing hooks **330** are mounted on the circumferential portions of the sensor receptacle **301** of the plunger body **300**, as illustrated in FIG. **17**. The sensor fixing hooks **330** can engage with the sensor module **20**, inserted into the sensor receptacle **301**, to be fixedly coupled to the sensor module **20**. Each of the coupled sensor fixing hooks **330** is rotatable about the rotary shaft **331**. When the plunger body **300** is in the first position, the sensor fixing hooks **330** are pressed inwardly by the internal container **102** to be engaged with the sensor module **20**. When the plunger body **300** is in the second position, the sensor fixing hooks **330** are released from the pressed state, thereby being disengaged from the sensor module **20**. In this regard, the hook guide **140** is provided on the internal container **102**.

[0112] As illustrated in FIG. **17**, each of the sensor fixing hooks **330** may include a pivot body **3301** on which the rotary shaft **331** is provided and a hook protrusion **3302** protruding from the bottom end portion of the pivot body **3301** to engage with the sensor module **20**. The plunger body **300** has rotary shaft coupling recesses **302** to which the rotary shafts **331** of the sensor fixing hooks **330** are coupled. In addition, engagement recesses **5112** conforming to the sensor fixing hooks **330** are formed in both end portions of the pod base **511** of the sensor module **20** to engage with the hook protrusions **3302** of the sensor fixing hooks **330** in a state in which sensor module **20** is inserted into the sensor receptacle **301**.

[0113] The hook guide **140** protrudes inward from the inner surface of the internal container **102** in the top-bottom direction. The inner surface of the hook guide **140** is comprised of a protruding surface **141** and a concave surface **142**. The protruding surface **141** presses the sensor fixing hooks **330**, while the concave surface **142** releases the sensor fixing hooks **330** from the pressed state. The concave surface **142** is configured to release the sensor fixing hooks **330** from the pressed state when the sensor fixing hooks **330** have moved to the second position together with the plunger body **300**. That is, the protruding surface **141** protrudes relatively inward to press the sensor fixing hooks **330** during the movement along a path between the first position and directly before the second position. Since the concave surface **142** is relatively concave, the concave surface **142** releases the sensor fixing hooks **330** from the pressed state when the plunger body **300** is in the second position.

[0114] Accordingly, as illustrated in FIG. **18***a*, when the plunger body **300** is in the first position, the sensor fixing hooks **330** are pressed inwardly by the protruding surface **141** of the hook guide **140** to engage with the sensor module **20** accommodated in the sensor receptacle **301**. As illustrated in FIG. **18***b*, when the plunger body **300** is moved linearly to the second position, the concave surface **142** of the hook guide **140** releases the sensor fixing hooks **330** from the pressed state, so that the sensor fixing hooks **330** can pivot about the rotary shaft **331** to disengage from the sensor module **20**. In this situation, i.e. in a situation in

which the plunger body **300** has moved to the second position together with the sensor module **20**, the sensor module **20** is attached to the skin by the adhesive tape **560**. In this state, when the applicator **10** is detached away from the human body, the sensor fixing hooks **330** are disengaged from the sensor module **20**, so that the applicator **10** is detached from the human body, and the sensor module **20** remains attached to the human body.

[0115] In addition, according to the disclosure, the applicator **10** and the sensor module **20** are fabricated, with the sensor module **20** being preinstalled in the applicator **10**. Accordingly, as described above, reuse, i.e. inserting another sensor module **20** into the applicator **10**, is prevented.

[0116] In this regard, an anti-return means for preventing the plunger body **300** from returning to the first position after having moved to the second position is provided in the main container **100**.

[0117] The anti-return means may include the anti-return hooks **104** elastically supported in a direction, in which the outer surface of the plunger body **300** is pressed, to engage with the top end portion of the plunger body **300** when the downward movement of the plunger body **300** from the first position to the second position is completed, as illustrated in FIGS. **19***a* and **19***b*.

[0118] As illustrated in FIG. **20**, each of the anti-return hooks **104** may include an elastic body **1041** formed of an elastic material and a hook portion **1042**. The elastic body **1041** extends downward from the inner top portion of the main container **100**. The hook portion **1042** protrudes from the bottom end portion of the elastic body **1041**. The elastic body **1041** may be formed integrally with the bottom surface of the container cover **103** coupled to the top end portion of the external container **101** of the main container **100**. In addition, the elastic body **1041** may have an elastically offset structure, i.e. the elastic body **1041** may be inclined toward the center axis in the direction of the bottom end, such that the hook portion **1042** can elastically press an outer surface portion of the plunger body **300**.

[0119] When the plunger body **300** is in the first position, the hook portions **1042** elastically press outer surface portions of the plunger body **300** due to the elastic force of the elastic bodies **1041**. When the plunger body **300** is in the second position, the hook portions **1042** are elastically moved toward the center axis by the elastic force of the elastic body **1041** to engage with the top end portion of the plunger body **300**.

[0120] Here, a stopper **1043** is provided on the bottom end portion of each of the elastic bodies **1041**. When the plunger body **300** is in the second position, the stoppers **1043** may be elastically moved by the elastic force of the elastic bodies **1041** to come into contact with outer surface portions of the plunger body **300**, thereby limiting the distance of the elastic movement of the elastic bodies **1041**.

[0121] According to the stoppers **1043** configured as above, in the process in which the elastic bodies **1041** elastically move toward the center in the second position of the plunger body **300**, the movement of the stoppers **1043** is restrained through contact with the outer surface portions of the plunger body **300**. In this position, the hook portions **1042** engage with the top end portion of the plunger body **300**. That is, the stoppers **1043** can limit excessive elastic movement of the elastic bodies **1041**, thereby guide accurate engagement between the hook portions **1042** and the plunger body **300**. In addition, even in the case in which the elastic kinetic force of the elastic bodies **1041** is significantly increased, the movement of the elastic bodies **1041** is restrained in a proper position. Accordingly, the elastic bodies **1041** can move more rapidly due to the increased elastic movement speed thereof, and thus, the anti-return operation can be performed reliably.

[0122] In addition, the applicator **10** is configured to withdraw and remove the needle **550** of the sensor module **20** from the body at the moment that the ejection movement of the sensor module **20** from the first position to the second position is completed. In this regard, the applicator **10** may include a needle withdrawing means N for withdrawing and removing the needle **550** from the body by moving the needle **550** upwardly at the moment that the movement of the plunger body **300** from the first position to the second position is completed.

[0123] The needle withdrawing means N may further include a needle withdrawing body **400** and a needle withdrawing elastic spring S**2**. The needle withdrawing body **400** is coupled to the needle head **551** of the needle **550** and engaged with the plunger body **300** to move linearly from the first position to the second position along with the plunger body **300** within the internal container **102**. The needle withdrawing elastic spring S**2** applies elastic force to the needle withdrawing body **400** in a direction in which the needle withdrawing body **400** moves upwardly toward the first position.

[0124] The needle withdrawing body **400** is engaged with the plunger body **300**. In this regard, the needle withdrawing body **400** has separate elastic hooks **410** that are elastically deformable. The elastic hooks **410** are elastically offset in a direction of engagement with a hook engaging portion **340** of the plunger body **300**. Accordingly, when the plunger body **300** moves linearly from the first position to the second position in response to the press button **110** being manipulated, the needle withdrawing body **400** also moves linearly to the second position together with the plunger body **300**.

[0125] Here, the internal container **102** is provided with a needle withdrawing pressing portion **130**. In response to the movement of the needle withdrawing body **400** to the second position, the needle withdrawing pressing portion **130** presses the elastic hooks **410** inwardly so that the elastic hooks **410** are disengaged from the hook engaging portion **340** of the plunger body **300**.

[0126] According to this structure, when the press button **110** is press-manipulated, the needle withdrawing body **400** moves from the first position to the second position together with the plunger body **300**. At the same time, the elastic hooks **410** of the needle withdrawing body **400** is pressed by the needle withdrawing pressing portion **130** of the internal container **102** to be disengaged from the hook engaging portion **340**. Then, due to the elastic force of the withdrawing elastic spring S**2**, the needle withdrawing body **400** returns upwardly to the first position.

[0127] Here, the needle withdrawing body **400** is coupled to the needle head **551** of the needle **550** via a needle head coupling portion **420** provided on one end portion thereof. During the upward return movement of the needle withdrawing body **400**, the needle **550** moves along with the needle withdrawing body **400** to be withdrawn and removed from the body. The needle head coupling portion **420** is provided on the bottom end portion of the needle withdrawing body **400** to engage with the coupling recess **552** of the needle head **551**.

[0128] The needle withdrawing body **400** can be moved upwardly to the top end portion of the inner surface of the main container **100** by the elastic force of the withdrawing elastic spring S**2**, instead of being moved upwardly to the first position. In this case, the needle withdrawing body **400**, driven by the elastic force, may create impacts while colliding with the top end portion of the inner surface of the main container **100**. To reduce such impacts, a buffer member **1031** may be provided on the top end portion of the inner surface of the main container **100**. Since the buffer member **1031** can minimize noise, users' worries about the operation of the device may be eliminated. The buffer member **1031** may be coupled to the container cover **103** provided in the top end portion of the main container **100**.

[0129] In addition, in response to the movement of the plunger body **300** to the second position by the elastic force of the elastic plunger spring S**1**, the sensor probe **521** and the needle **550** of the sensor module **20** are inserted into the human body. During the insertion of the needle **550** into the human body, resistance to the insertion may generate reaction force, by which the needle **550** may be moved backwardly in the direction opposite to the direction in which the needle **550** is inserted into the human body. In this case, since the sensor probe **521** may not be inserted into the body to a proper depth, it may be preferred that the backward movement of the needle **550** is prevented. In this regard, a needle support block **430** may be coupled to the needle withdrawing body **400**. The needle support block **430** may support the top end portion of the needle **550** so that the needle **550** does not move upwardly with respect to the needle withdrawing body **400**.

[0130] Next, the use of the above-described sensor applicator assembly will be described with reference to FIGS. **21** to **24**.

[0131] FIGS. **21** to **24** are views sequentially illustrating the use of the sensor applicator assembly for a continuous glucose monitoring system according to embodiments of the disclosure, in a stepwise manner.

[0132] First, as illustrated in FIG. **21**, the protective cap **200** of the applicator **10** is detached. In the process in which the protective cap **200** is detached, the release paper **561** of the adhesive tape **560** of the sensor module **20** is detached together with the protective cap **200**, thereby being removed from the adhesive tape **560**. Afterwards, the sensor applicator assembly is located on a portion of the body, to which the sensor module **20** is to be attached. In this state, the safety locking device **120** is removed from the sensor applicator assembly.

[0133] When the press button **110** is press-manipulated in a state in which the safety locking device **120** is removed, the plunger body **300** is moved downwardly in an ejecting direction by the elastic plunger spring S**1**, as illustrated in FIGS. **22***a* and **22***b*. In this process, the needle **550** and the sensor probe **521** of the sensor module **20** are inserted into the body E. Here, the sensor module **20** is bonded to the surface of the body E via the adhesive tape **560**. When the plunger body **300** is moved in the ejecting direction, the plunger body **300** cannot move upwardly again, engaged by the anti-return hooks **104** of the external container **101**. Accordingly, after the applicator **10** is used once, the applicator **10** cannot be reused.

[0134] When the plunger body **300** is moved downwardly, as illustrated in FIG. **22***a*, the sensor fixing hooks **330** of the sensor receptacle **301** are released from the pressed state by the concave surface **142** of the hook guide **140**, thereby being disengaged from the sensor module **20**. In addition, the elastic hooks **410** of the needle withdrawing body **400** are pressed inwardly by the needle withdrawing pressing portion **130** of the internal container **102**, thereby being disengaged from the plunger body **300**.

[0135] Accordingly, when the plunger body **300** is moved downwardly, the needle withdrawing body **400** is simultaneously returned upwardly by the withdrawing elastic spring S**2**, as illustrated in FIG. **23**. Here, the needle **550** is moved upwardly along with the needle withdrawing body **400**, so that the needle **550** is withdrawn and removed from the body E.

[0136] In this state, the sensor fixing hooks **330** is disengaged from the sensor module **20** as described above. As illustrated in FIG. **24**, the applicator **10** can be detached and removed upwardly. When the applicator **10** is detached and removed in this manner, only the sensor module **20** remains attached to the body E. Afterwards, the transmitter **30** is coupled to the sensor module **20** so as to be connected to the connector terminal **513**, and the transmitter **30** transmits a glucose measurement result, obtained by the sensor module **20**, to the user terminal.

[0137] The foregoing descriptions have been presented in order to explain certain principles of the present disclosure by way of example. A person skilled in the art to which the present disclosure relates could make various modifications and variations without departing from the essential features of the present disclosure. The foregoing embodiments disclosed herein shall be interpreted as being illustrative, while not being limitative, of the principle and scope of the present disclosure. It should be understood that the scope of the present disclosure shall be defined by the appended Claims and all of their equivalents fall within the scope of the present disclosure.

1. A sensor applicator assembly for a continuous glucose monitoring system, the sensor applicator assembly being assembled as a single unitary product in which a sensor module periodically measuring a blood glucose level is preinstalled in an applicator, such that the sensor module is ejected by an operation of the applicator to be attached to a human body,

wherein a separate protective cap is detachably coupled to the applicator to block the sensor module, preinstalled in the applicator, from being exposed externally, and

adhesive tape and a release paper are attached to a body contact surface of the sensor module to enable the sensor module to be attached to the human body, the release paper of the adhesive tape being detached and removed from the adhesive tape together with the protective cap while the protective cap is being detached from the applicator.

2. The sensor applicator assembly according to claim **1**, wherein the protective cap includes:

an outer cover coupled to one end portion of the applicator while surrounding an outer circumferential surface of the applicator;

an extension extending from one end of the outer cover in a direction of an inner center of the applicator; and

an inner support extending upward from one end of the extension to support the body contact surface of the sensor module inserted into the applicator.

3. The sensor applicator assembly according to claim 2, wherein the adhesive tape and the release paper are disposed between the body contact surface of the sensor module, and

the release paper is attached to a top surface of the inner support of the protective cap coupled to the applicator, such that the release paper is detached and removed from the adhesive tape together with the protective cap while the protective cap is being detached from the applicator.

4. The sensor applicator assembly according to claim 3, wherein a separate adhesive member is bonded to an exposed surface of the release paper, such that the release paper is attached to the top surface of the inner support of the protective cap.

5. The sensor applicator assembly according to claim 4, wherein two parallel cutting lines having the same width and size as those of the adhesive member are provided in portions of the release paper.

6. The sensor applicator assembly according to claim 1, wherein the protective cap is provided with a locking member to prevent the protective cap, coupled to the applicator, from being detached from the applicator,

the locking member being configured to be locked or unlocked by a user's manipulation.

7. The sensor applicator assembly according to claim 6, wherein the applicator is provided with a locking catch recess, and

the locking member includes:

a locking lever pivotably coupled to one side of the protective cap; and

a locking catch protrusion provided on one end of the locking lever to be inserted into and engaged with the locking catch recess,

wherein the locking lever is elastically supported in a direction in which the locking catch protrusion is inserted into and engaged with the locking catch recess.

8. The sensor applicator assembly according to claim 2, wherein the protective cap is provided with a locking member to prevent the protective cap, coupled to the applicator, from being detached from the applicator, the locking member being configured to be locked or unlocked by a user's manipulation.

9. The sensor applicator assembly according to claim 3, wherein the protective cap is provided with a locking member to prevent the protective cap, coupled to the applicator, from being detached from the applicator, the locking member being configured to be locked or unlocked by a user's manipulation.

10. The sensor applicator assembly according to claim 4, wherein the protective cap is provided with a locking member to prevent the protective cap, coupled to the applicator, from being detached from the applicator, the locking member being configured to be locked or unlocked by a user's manipulation.

11. The sensor applicator assembly according to claim 5, wherein the protective cap is provided with a locking member to prevent the protective cap, coupled to the applicator, from being detached from the applicator, the locking member being configured to be locked or unlocked by a user's manipulation.

* * * * *