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(54) Title: DRUG INFUSION DEVICE WITH SECURITY BASE

(57) Abstract: The invention discloses a drug infusion device with security base comprises a reservoir, used for accommodating the drug to be infused, provided with a piston and a screw; a driving wheel, connected with the screw, driving the screw to push the piston forward by rotation; an infusion needle unit, including an infusion needle and a infusion needle holder, the infusion needle holder is used to fixedly place the infusion needle, when the infusion needle unit is at the non-initial position, the infusion needle communicated with the reservoir; an adhesive patch, for attaching the infusion device module to the skin surface; and a security base, arranged on the bottom of the adhesive patch, provided with an infusion needle accommodating part, for accommodating the infusion needle when the infusion device is priming. The infusion needle accommodating part can accommodate the infusion needle protruding from the adhesive patch, preventing the infusion needle from stabing the user, and at the same time, accommodate the drug flowed out from the infusion needle, preventing the drug being contaminated and causing safety risks.

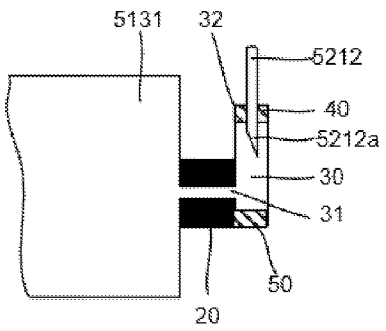


FIG.16c

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DRUG INFUSION DEVICE WITH SECURITY BASE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of PCT application no. PCT/CN2021/070207, filed on Jan 5, 2021, PCT/CN2021/102333, filed on Jun 25, 2021, PCT/CN2021/111219, filed on Aug 6, 2021, and PCT/CN2021/117647, filed on Sep 10, 2021. The entirety of the above mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

TECHNICAL FIELD

The present invention mainly relates to the field of medical instruments, in particular to a drug infusion device with security base.

BACKGROUND

In a healthy person, the pancreas can automatically monitor the amount of glucose in the blood and automatically secrete the required dosage of insulin/glucagon. However, for diabetic patients, the function of their pancreas has been severely compromised, and the pancreas cannot secrete the required dosage of insulin. Therefore, diabetes mellitus is defined as a metabolic disease caused by abnormal pancreatic function, and it is also classified as one of the top three chronic conditions by the WHO. The present medical advancement has not been able to find a cure for diabetes mellitus. Yet, the best the technology could do is control the onset symptoms and complications by stabilizing the blood glucose level for diabetes patients.

Diabetic patients on an insulin pump need to check their blood glucose before infusing insulin into their bodies. At present, most detection methods can continuously detect blood glucose and send the blood glucose data to the remote device in real-time for the user to view. This detection method is called Continuous Glucose Monitoring (CGM), which requires the detection device to be attached to the surface of the patients' skin, and the sensor carried by the device to be inserted into the interstitial fluid for testing. According to the blood glucose (BG) level, the infusion device mimics an artificial pancreas to fill the gaps of the required insulin amount via the closed-loop pathway or the semi-closed-loop pathway.

Before the drug is infused into the body, the drug infusion device needs priming to expel the air in the fluid path, to prevent air from being infused into the body and causing safety risks. However, during the priming, the infusion needle will protrude from the bottom of the infusion device, and exposed to the air. At the same time, in order to ensure complete priming, part of the medicine will flow out from the infusion needle. If it is not properly treated, the protruding needle may stab the user, and the exposed drug will be contaminated, if the contaminated drug is infused into the body, it may cause safety risks.

Therefore, in the prior art, there is an urgent need for a drug infusion device that can improve safety when the drug infusion device is priming.

BRIEF SUMMARY OF THE INVENTION

The invention discloses a drug infusion device with security base, the security base is provided with an infusion needle accommodating part, which can accommodate the infusion needle when the infusion device is priming, preventing the infusion needle from stabing the user, and at the same time, accommodate the drug flowed out from the infusion needle, preventing the drug being contaminated and causing safety risks.

The Invention discloses a drug infusion device with security base that includes a reservoir, used for accommodating the drug to be infused, provided with a piston and a screw; a driving wheel, connected with the screw, driving the screw to push the pistion forward by rotation; an infusion needle unit, including an infusion needle and a infusion needle holder, the infusion needle holder is used to fixedly place the infusion needle, when the infusion needle unit is at the non-initial position, the infusion needle communicated with the reservoir; an adhesive patch, for attaching the infusion device module to the skin surface; and a security base, arranged on the bottom of the adhesive patch, provided with an infusion needle accommodating part, for accommodating the infusion needle when the infusion device is priming.

According to one aspect of the present invention, the thickness of the security base is gradually decreased from the end close to one end of the adhesive patch to the middle part of the adhensive patch, and forms a plane with the other end of the adhesive patch.

According to one aspect of the present invention, the bonding surface of the security base and the adhesive patch is equilateral trapezoidal.

According to one aspect of the present invention, the adhesive patch includes at least one layer of tape and a protective film, the protective film is fixed around the outer contour of the at least one layer of tape.

According to one aspect of the present invention, the adhesive patch includes at least two layers of tape.

According to one aspect of the present invention, the adhesive patch further includes at least one layer of protective film.

According to one aspect of the present invention, the rockwell hardness of the protective film is greater than that of the tape.

According to one aspect of the present invention, the adhesive patch includes a plurality of tapes and a plurality of protective films, and every two tapes are separated by a protective film.

According to one aspect of the present invention, the outer tape completely covers the inner tape.

According to one aspect of the present invention, the outer tape at least partially covers the inner tape.

According to one aspect of the present invention, the protective film is provided with at least one

tearing portion.

According to one aspect of the present invention, at least one tearing portion is provided on the inner protective film.

According to one aspect of the present invention, the adhesive patch further includes a release paper. The tape and the release paper are respectively provided with a first through hole and a second through hole for the infusion needle to pass through. The diameter of the first through hole and the second through hole is smaller than the diameter of top opening of the infusion needle accommodating part.

According to one aspect of the present invention, the security base is provided with a third through hole.

According to one aspect of the present invention, the third through hole is tapered.

According to one aspect of the present invention, the infusion needle is a U-shaped steel needle.

According to one aspect of the present invention, the infusion device includes an infusion mechanism module and a control mechanism module. The drug reservior, the drive wheel, and the infusion needle unit are arranged on the infusion mechanism module.

According to one aspect of the present invention, the infusion mechanism module and the control mechanism module are designed separately, and the control mechanism module can be reused.

According to one aspect of the present invention, the infusion mechanism module and the control mechanism module are electrically connected by an electrical contact.

According to one aspect of the present invention, the infusion mechanism module and the control mechanism module are disposed of in one housing, discarded together after a single-use.

Compared with the prior art, the technical solution of the present invention has the following advantages:

In the drug infusion device with security base disclosed by the present invention, the security base is provided with an infusion needle accommodating part, which can accommodate the infusion needle when the infusion device is priming, preventing the infusion needle from stabing the user, and at the same time, accommodate the drug flowed out from the infusion needle, preventing the drug being contaminated and causing safety risks.

Furthermore, the bonding surface of the security base and the adhesive patch is equilateral trapezoidal, and the thickness of the security base is gradually decreased and forms a plane with the other end of the adhesive patch, the infusion device can be placed on the table stably, and at the same time, reduce the total weight and the volume of the infusion device.

Furthermore, the adhensive patch further includes a release paper, the tape and the release paper are respectively provided with a first through hole and a second through hole for the infusion needle to pass through. The diameter of the first through hole and the second through hole is smaller than the diameter of top opening of the infusion needle accommodating part, preventing

the drug contained in the infusion needle accommodating part from overflowing from the opening of the infusion needle accommodating part and infiltrating into the tape, which will cause the poor adhesiveness of the tape, and affect the user experience.

Further, a tapered hole is provided on the security base, to facilitate guiding an external drug filling device to fill drug.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1a and FIG.1b are schematic top views of the drug infusion device according to two embodiments of the present invention.

FIG.2a and FIG.2b are schematic views of the control mechanism module according to an embodiment of the present invention.

FIG.3a is a schematic view of the infusion mechanism module according to an embodiment of the present invention.

FIG.3b is a side view of the assembly of the control mechanism module and the infusion mechanism module according to an embodiment of the present invention.

FIG.3c is a schematic top view of the lower case of the infusion mechanism module according to an embodiment of the present invention.

FIG.3d is a schematic top view of the lower case of the infusion mechanism module according to another embodiment of the present invention.

FIG.4a and FIG.4b are schematic views of the internal mechanism module of the infusion mechanism module according to an embodiment of the present invention, respectively.

FIG.4c is a schematic view of the internal mechanism module of the infusion mechanism module according to another embodiment of the present invention.

FIG.5 is a schematic view of the elastic conductor according to an embodiment of the present invention.

FIG.6 is a schematic view of the conductive tower-spring according to an embodiment of the present invention.

FIG.7 is a partially enlarged view of the part M portion in FIG.4a according to en embodiment of the present invention.

FIG.8a and FIG.8b are schematic views of the driving wheel assembly and the frame before and after assembly according to the embodiment of the present application embodiment, respectively.

FIG.8c is a schematic view of the shield according to an embodiment of the present invention.

FIG.9a-FIG.9d are schematic views of the movable block opened or closed according to an embodiment of the present invention, respectively.

FIG.10a a schematic view of the adhesive patch according to an embodiment of the present invention.

FIG.10b a schematic view of each layer of the adhesive patch according to an embodiment of the present invention.

FIG.10c a schematic view of the cascading sequence of the adhesive patch according to an embodiment of the present invention.

FIG.10d a schematic view of each layer of the adhesive patch with multiple tapes according to an embodiment of the present invention.

FIG.10e a schematic view of the cascading sequence of the adhesive patch with multiple tapes according to an embodiment of the present invention.

FIG.11a and FIG.11b are schematic views of the control mechanism module and infusion mechanism module according to another embodiment of the present invention.

FIG.12a is a schematic view of the in-position detection module comprising a voltage transformer device according to an embodiment of the invention.

FIG.12b is a schematic view of the in-position detection module comprising a magnetic component according to an embodiment of the invention.

FIG.12c is a schematic view of the in-position detection module comprising an inductor coil according to an embodiment of the invention.

FIG.12d is a schematic view of the in-position detection module comprising a capacitive lower plate according to an embodiment of the invention.

FIG.13 is a schematic view of the threshold interval of a normal in-position signal according to an embodiment of the invention.

FIG.14 is a schematic view of the infusion mechanism module's internal mechanism module comprising a blockage detection module according to another embodiment of the present invention.

FIG.15a is an exploded view of the infusion mechanism module according to an embodiment of the present invention.

FIG.15b is a schematic view of the lower case according to an embodiment of the present invention.

FIG.15c is a schematic view of the frame according to an embodiment of the present invention.

FIG.16a is a schematic view of the infusion device according to another embodiment of the present invention.

FIG.16b is a schematic view of the needle mechanism according to an embodiment of the present invention.

FIG.16c is a schematic view of thereservoir and the cavity according to the embodiment of the present invention.

FIG.16d is a schematic view of the security base according to an embodiment of the present invention.

DETAILED DESCRIPTION

As mentioned above, in the prior art, when priming, the infusion needle will protrude from the bottom of the infusion device, and exposed to the air, at the same time, part of the medicine will flow out from the infusion needle, appropriate treatment is required to avoid security risks.

In order to solve this problem, the present invention provides a drug infusion device with security base, the security base is provided with an infusion needle accommodating part, which can accommodate the infusion needle when the infusion device is priming, preventing the infusion needle from stabing the user, and at the same time, accommodate the drug flowed out from the infusion needle, preventing the drug being contaminated and causing safety risks.

Various exemplary embodiments of the present invention will now be described in detail regarding the figures. The relative arrangement of the components and the steps, numerical expressions and numerical values outlined in the embodiments are not construed as limiting the scope of the invention.

In addition, it should be understood that, for ease of description, the dimensions of the various components shown in the figures are not necessarily drawn in the actual scale relationship; for example, the thickness, width, length or distance of certain units may be exaggerated relative to other mechanism modules.

The following description of the exemplary embodiments is merely illustrative and does not limit the invention its application or use. The techniques, methods, and devices are known to those of ordinary skill in the art and may not be discussed in detail. However, such techniques, methods, and devices should be considered as part of the specification.

It should be noted that similar reference numerals and letters indicate similar items in the following figures. Therefore, once an item is defined or illustrated in a drawing, it will not be discussed further in the following description of the drawings.

FIG.1a and FIG.1b are schematic top views of the drug infusion device according to two embodiments of the present invention.

In the embodiment of the present invention, the drug infusion device with security base comprises a control mechanism module 100, an infusion mechanism module 110 and an adhesive patch 120, which will be described separately below. In other embodiments of the present invention, the patch-type drug infusion device may include more parts, which are not specifically limited here.

The patch-type drug infusion device refers to a tubing-free infusion device that is entirely pasted

on the user's skin surface by the one piece of adhesive patch 120. And the infusion device is provided with an infusion needle unit 121, integrated on the infusion device, instead of a long tube; therefore, the drug can be directly infused from the reservoir 131 to the subcutaneous tissue through the infusion needle unit 121.

In the embodiment of the present invention, the infusion mechanism module 110 and the control mechanism module 100 are designed separately and connected by a waterproof plug or directly engaged and electrically connected into a whole. Details regarding how the reliability of the electrical connection has been improved when the infusion mechanism module 110 and the control mechanism module 100 are directly engaged and electrically connected into a whole will be described below. The infusion mechanism module 110 can be reused, and the control mechanism module 100 is discarded after a single use, as shown in FIG.1a. In another embodiment of the present invention, the infusion mechanism module 110 and the control mechanism module 100 are connected by a wire and disposed of inside the same housing 10. Attached to a certain position of the user's skin by the adhesive patch 120, both units will be discarded together after a single use, as shown in FIG.1b.

The patch-type drug infusion device of the embodiment of the present invention includes a control mechanism module 100, which receives signals or information from a remote device or a body fluid parameter detection device (such as CGM), and controls the infusion device to infuse drug(s) accordingly.

Inside the housing 101 of the control mechanism module 100 are disposed of program modules, circuit board(s) and related electronic units for receiving signals or issuing control instructions, as well as other mechanical units or parts necessary for realizing the infusion function, which is not limited herein. In another embodiment of the present invention, a power supply 133 can also be provided in the control mechanism module. Preferably, in the embodiment of the present invention, the power supply 133 is provided in the infusion mechanism module 110, which will be described below.

FIG.2a and FIG.2b are schematic views of the control mechanism module according to an embodiment of the present invention.

The control mechanism module 100 further includes the first electrical contact 103 exposed on its surface. The first electrical contact 103 is used as a circuit connection terminal to connect the internal circuits provided in the control mechanism module 100 and the infusion mechanism module 110, respectively. The embodiment of the present invention does not specifically limit the position of the first electrical contact 103.

Compared with the plug connector used as a connection terminal in the prior arts, the contact area of the electrical contact is much smaller, which provides more flexibility to the mechanism module design, and can effectively reduce the volume of the control mechanism module. At the same time, these smaller electrical contact can be directly connected to the internal circuit or electrical components. They could also be directly soldered on the circuit board, which helps to optimize the design of the internal circuit and effectively reduce the complexity of the circuit,

thereby saving costs and reducing the volume of the infusion device. Furthermore, the electrical contact are exposed on the surface of the control mechanism module 100 to facilitate electrical connection with connection ends on other mechanism modules.

The type of the first electrical contact 103 includes rigid metal pins or elastic conductive members. Preferably, in the embodiment of the present invention, the first electrical contact 103 is a rigid metal pin. One end of the first electrical contact 103 is electrically connected to the connection end provided inside the control mechanism module 100. In contrast, the other end is exposed on the surface of the lower housing 101b. The rest part of the first electrical contact 103 is tightly embedded in the housing 101, thus keeping the internal control mechanism module 100 isolated from the outside.

The elastic conductive member includes conductive spring, conductive silica gel, conductive rubber, or conductive leaf spring. One end of the elastic conductive member is used to electrically connect with the internal connection end in the control mechanism module 100, while the other end is used to connect with other connection ends electrically.

As in an embodiment of the present invention, the first electrical contact 103 is a conductive spring. When the electrical contact are in contact with each other, the elasticity of the conductive spring can enhance the reliability of the electrical connection. Similar to the rigid metal pin, one end of the conductive spring is exposed on the surface of the lower housing 101b. In contrast, the remaining part of the conductive spring is tightly embedded in the housing 101 and electrically connected with internal circuits or electrical components. The connection end disposed inside the control mechanism module 100 can be a conductive lead, a specific part of a circuit, or an electrical element.

It should be noted that the "tightly embedded" in the embodiment of the present invention suggests that there is no gap between the electrical contact and the housing 101, keeping the control mechanism module 100 tightly sealed. The following "tightly embedded" has the same meaning as here.

In another embodiment of the present invention, the first electrical contact 103 is a conductive spring, but it is not tightly embedded in the housing 101. Instead, a sealing element is provided in a groove, both of which are disposed around the area where the first electrical contact 103 is located, thus sealing the electrical contact area and the control mechanism module 100.

In the embodiment of the present invention, the control mechanism module 100 is further provided with the first engaging portions 102, which is used to fasten the second engaging portion 112 disposed on the infusion mechanism module 110 to assemble the control mechanism module 100 infusion mechanism module 110. Details regarding how the mechanism works to enable the electrical connection between the first electrical contact 103 and the second electrical contact 113 will be described below.

The first engaging portion 102 and the second engaging portion 112 include one or more hooks, blocks, holes, and slots that can be engaged with each other. The positions of the hooks, blocks, holes, and slots can be flexibly adjusted, according to the shape and mechanism module features

of the control mechanism module 100 and the infusion mechanism module 110, such as disposed in the interior or on the surface of the corresponding mechanism module, which is not specifically limited herein.

In the embodiment of the present invention, the control mechanism module 100 is further provided with a concave 104 that fits the convex portion 114 disposed at the bottom of the case of the infusion mechanism module 110, which will be described in detail below. Preferably, the first electrical contact 103 is provided in the concave 104, as shown in FIG.2b.

In the embodiment of the present invention, a buzzer (not shown) is also provided in the control mechanism module 100. When the infusion process starts or ends, the infusion device malfunctions, the drug is exhausted, the control mechanism module 100 issues an error command or receives an error message, etc., the buzzer is used to issue alarm signals, such as sound or vibration, notifying the user to adjust or replace the device in time.

Preferably, in the embodiment of the present invention, the housing 101 of the control mechanism module 100 is provided with a sound-permeable outlet 105 to allow the sound alarm signal from the buzzer to be sent out. In order to achieve a good sealing effect and ensure the normal operation of the buzzer, a waterproof sound-permeable membrane (not shown) is disposed between the sound-permeable outlet 105 and the buzzer. Therefore, the waterproof sound-permeable membrane needs to have a certain porosity to ensure the sound transmission but prevent water molecules penetration.

Compared with the traditional technical solution in which the buzzer is entirely enclosed in the control mechanism module 100, because of the sound-permeable outlet 105, a less loud sound signal emitted from the buzzer would be enough to raise the user's attention, which reduces the energy consumption of the buzzer, thereby optimizing the power consumption configuration of the infusion device and saving production costs.

FIG.3a is a schematic view of the infusion mechanism module 110 according to the embodiment of the present invention. FIG.3b is a side view of the assembly of the control mechanism module 100 and the infusion mechanism module 110 according to the embodiment of the present invention. FIG.3c is a schematic top view of the lower case of the infusion mechanism module according to an embodiment of the present invention. FIG.3d is a schematic top view of the lower case of the infusion mechanism module according to another embodiment of the present invention.

The drug infusion device with security base further includes an infusion mechanism module 110 with a case. A mechanical module, an electric control module, and other auxiliary modules for completing the drug infusion process are provided inside the case, which will be described in detail below. The case of the infusion mechanism module 110 may include multiple parts. As in the embodiment of the present invention, the case of the infusion device includes an upper case 111a and a lower case 111b.

As mentioned above, in the embodiment of the present invention, the infusion mechanism module 110 is provided with the second engaging portions 112, which is used to engaged and

fasten the corresponding first engaging portions 102. The positions where the first engaging portions 102 and the second engaging portions 112 are provided correspondingly.

In the embodiment of the present invention, the infusion mechanism module 110 is provided with second electrical contact 113, which are used to press against the corresponding first electrical contact 103 to create an electrical connection between the control mechanism module 100 and the infusion mechanism module 110. The compression between these two corresponding electrical contact disposed on different parts can improve the reliability of the electrical connection. Similar to the first electrical contact 103, one of the second electrical contact 113 also includes a rigid metal pin and an elastic conductive member. Preferably, in the embodiment of the present invention, the second electrical contact 113 is a conductive spring. Similarly, the conductive spring can improve the electrical connection performance. A groove is also arranged around the area where the second electrical contact 113 is disposed, and a sealing member 115 is arranged in the groove. Similarly, the elasticity of the conductive spring can further improve the electrical connection performance.

Preferably, in the embodiment of the present invention, the two ends of the conductive spring have different diameters. And the diameter of the end exposed to the outside of the infusion mechanism module 110 is shorter than that of the end inside the infusion mechanism module 110. In this way, the conductive spring can be held in the case because of the longer diameter; Thus, when the control mechanism module 100 is not installed on the infusion mechanism module 110, the longer diameter of the inner end can prevent the conductive spring from detaching from the infusion mechanism module 110.

The embodiment of the present invention does not limit the position at where second electrical contact 113 is arranged, as long as it can be electrically connected to the corresponding first electrical contact 103. Preferably, in the embodiment of the present invention, the upper case 111a of the infusion mechanism module 110 includes a convex portion 114 where the second electrical contact 113 is disposed, as shown in FIG.3a. The shape of the convex portion 114 corresponds to that of the concave 104 disposed on the control mechanism module 100, allowing the two portions to tightly fit each other and press the first electrical contact 103 and the corresponding second electrical contact 113 against each other to realize the electrical connection.

In other embodiments of the present invention, the convex portion 114 may be provided on the lower case 111b. When the infusion mechanism module 110 includes an integral case, the convex portion 114 will be a part of the integral case not specifically limited herein.

The method of assembling the control mechanism module 100 and the infusion mechanism module 110 to each other includes pressing the control mechanism module 100 on the infusion mechanism module 110 along the thickness direction of the infusion mechanism module 110, thereby engaging the first engaging portion 102 and the second engaging portion 112; or pressing the control mechanism module 100 on the infusion mechanism module 110 along the length direction of the infusion mechanism module 110. Alternatively, the control mechanism module 100 can be pressed along with any angle between the thickness direction and the length direction of the infusion mechanism module 110, making the first engaging portion 102 and the second

engaging portion 112 engaged with each other. Preferably, in the implementation of the present invention, the method by which the control mechanism module 100 and the infusion mechanism module 110 are assembled is to press the control mechanism module 100 on the infusion mechanism module 110 along with the thickness direction of the infusion mechanism module 110, making the first engaging portion 102 and the second engaging portion 112 engaged with each other, as shown the installation direction in FIG.3b.

In the embodiment of the present invention, the lower case 111b of the infusion mechanism module 110 further includes an outward extending portion 116. A block 117 is provided outside the outer extending portion 116, as shown in FIG.3a. As mentioned above, the control mechanism module 100 is pressed to the engaging position along the thickness direction of the infusion mechanism module 110; thus, block 117 can prevent the control mechanism module 100 from detaching along the length direction of the infusion mechanism module 110, ensuring the normal operation of the infusion device. Obviously, in another embodiment of the present invention, if the control mechanism module 100 is pressed to the engaging position along with other directions, the control mechanism module 100 can also be prevented from detaching from the infusion mechanism module 110 by adjusting the position of the block 117.

It should be noted here that "outer" and "outside" are relative to the main body of the infusion mechanism module 110, where they belong to a concept of the relative position, as shown in FIG.3a or FIG.3b. The "outside" below have the same meaning as here.

In the embodiment of the present invention, the outer end of the outer extending portion 116 is also provided with a pressing portion 118 for releasing the blocking effect of block 117. While the user is replacing the infusion mechanism module 110, the control mechanism module 100 can be released from block 117 by pressing the pressing portion 118 with a finger. Then, the user can remove the control mechanism module 100 from the infusion mechanism module 110 with two fingers.

Another embodiment of the present invention can also be provided with an unlocking hole 119 disposed of in the inner side of block 117. While the pressing portion 118 is pressed, a finger can enter the unlocking hole 119, thereby pushing the control mechanism module 100 out to separate the control mechanism module 100 from the infusion mechanism module 110. In the embodiment of the present invention, the unlocking hole 119 is square. The square unlocking hole 119 can facilitate the smooth entry of fingers. In other embodiments of the present invention, the unlocking hole 119 may also have other shapes, which is not specifically limited here.

The lower case 111b of the infusion mechanism module 110 is also provided with one or more crease grooves 140. Two crease grooves 140 are provided on both sides of the unlocking hole 119, as shown in FIG.3c and FIG.3d. After the crease groove, 140 is provided, the thickness or width of the lower case 111b at the crease groove 140 (as shown by the arrows in FIG.3c and FIG.3d) is reduced. When the user presses the pressing portion 118, the lower case 111b is easily broken at the crease groove 140, and the blocking of the control mechanism module 100 by block 117 is more smoothly released.

Preferably, in the embodiment of the present invention, two crease grooves 140 are provided at the both ends of block 117, respectively, as shown in FIG.3c. In another embodiment of the present invention, the crease groove 140 is provided on two corresponding lateral sides of the unlocking hole 119, as shown in FIG.3d.

The drug infusion device with security base further includes a infusion needle unit 121, used for infusing the drug to the subcutaneous tissue.

An adhesive patch 120 is also provided on the bottom of the lower case 111b to attach the infusion device to the user's skin surface.

FIG.4a and FIG.4b are two schematic views of the internal mechanism module 130 of the infusion mechanism module 110 of the embodiment of the present invention from two perspectives, respectively. FIG.4c is a schematic view of the internal mechanism module 130 of the infusion mechanism module according to another embodiment of the present invention.

In the embodiment of the present invention, the internal mechanism module 130 includes mechanical units and electronic control units used to realize the infusion function, such as a reservoir 131, a drug outlet 132, a power supply 133, a driving wheel 134, a screw 135, a circuit board (not shown), a driving unit 1310, etc. The movement of the driving unit 1310 drives the driving wheel 134 to rotate, thus making the screw 135 push the piston 312 (as shown in FIG.14) in the reservoir 131 forward, realizing the drug infusion.

In the embodiment of the present invention, the power supply 133 is a conventional button battery. In other embodiments of the present invention, the power supply 133 may also be other types of batteries, as long as it can meet the requirements for supplying power to the infusion device. Preferably, in the embodiment of this present invention, the type of the power supply 133 is a double-row battery pack; that is, two rows of button batteries are arranged on both sides of the driving wheel 134, respectively, as shown in FIG.4b. Conventionally, the discharge capacity of button batteries is low. The double-row button battery pack can reduce the discharge level of each battery, thereby extending the service life of the battery. Furthermore, the double-row design of the power supply 133 can make the full use of the internal space and improve the integration within the internal mechanism module in the infusion device.

The infusion mechanism module 110 in the embodiment of the present invention is also provided with a circuit board or multiple three-dimensional circuits coated on the surface of a part of the mechanism module for supplying power to specific structural units. According to the internal arrangement characteristics of the infusion device, the shape and position of the three-dimensional circuit can be flexibly designed, which can make the full use of the internal space of the infusion mechanism module, making the arrangement more compact. The circuit board is a hard/rigid circuit board or a flexible circuit board. Preferably, in the embodiment of the present invention, the circuit board is flexible. The shape of the flexible circuit board is adjustable, allowing it to be flexibly designed according to the internal space of the infusion mechanism module 110. At the same time, multiple connection ends can be provided on the flexible circuit board to be electrically connected to second electrical contact 113, thereby connecting the circuits

of the control mechanism module 100 and the infusion mechanism module 110, allowing the infusion device to perform drug infusion function.

An elastic conductor 136 is also provided inside the infusion mechanism module 130. The elastic conductor 136 is electrically connected to the power supply 133, and the specific connection end on the circuit board (or three-dimensional circuit), thereby supplying power to specific structural units.

FIG.5 is a schematic view of the elastic conductor according to an embodiment of the present invention.

In the embodiment of the present invention, the elastic conductor 136 includes a first elastic conductor 136a and a second elastic conductor 136b, the first elastic conductor 136a is connected with the power supply 133, and the second elastic conductor 136b is connected with the specific connection end on the circuit board (or three-dimensional circuit). At least a protrusion 1361 is provided on the first elastic conductor 136a and the second elastic conductor 136b, which facilitate the point contact connection or the line contact connection between the first elastic conductor 136a and the power supply 133, and also facilitate the point contact connection or the line contact connection between the second elastic conductor 136b and the specific connection end on the circuit board (or three-dimensional circuit), thereby improving the electrical connection reliability between the elastic conductor 136 and the power supply 133, and the specific connection end on the circuit board (or three-dimensional circuit). When the first elastic conductor 136a and the second elastic conductor 136b is flat, during use, it is likely to cause a poor connection between the elastic conductor 136 and the power supply 133 and the specific connection end on the circuit board (or three-dimensional circuit), thereby affecting the use effect. In the embodiment of the present invention, protrusion 1361 may be a linear protrusion formed by bending the first elastic conductor 136a or the second elastic conductor 136b, or it may be several dots or other shapes of protrusions formed by other means on the first elastic conductor 136a or the second elastic conductor 136b. The form and number of the protrusions 1361 on the first elastic conductor 136a or the second elastic conductor 136b can be the same or different. Here, the form, number, and forming method of the protrusions 1361 are not specifically limited, as long as the point contact connection or line contact connection between the elastic conductor 136 and the power supply 133 and the specific connection end on the circuit board (or three-dimensional circuit) can be enhanced, improving the reliability of the electrical connection.

In the embodiment of the present invention, the first elastic conductor 136a and the second elastic conductor 136b are approximately arranged in an "L" shape, the first elastic conductor 136a is approximately parallel to the frame 137, and the second elastic conductor 136b is approximately perpendicular to the frame 137. In other embodiments of the present invention, the first elastic conductor 136a and the second elastic conductor 136b can also be arranged in other shapes, which are not specifically limited here, as long as the power supply 133 and the specific connection end on the circuit board (or three-dimensional circuit) can be electrically connected. An insulating member 1362 is also provided at the junction of the first elastic conductor 136a and the second elastic conductor 136b (as shown at the position L in FIG.5) to prevent the power unit

1311 from contacting the elastic conductor 136 and causing a short circuit during operation, further stop the infusion mechanism module 130 from working. In the embodiment of the present invention, the insulating member 1362 is formed by printing ink. In other embodiments of the present invention, the insulating member 1362 may also be insulating glue, insulating varnish or insulating material, which is not specifically limited herein.

In the embodiment of the present invention, the elastic conductor 136 may be a sheet metal including the first elastic conductor 136a and the second elastic conductor 136b or may be intergrated by the single first elastic conductor 136a and the single second elastic conductor 136b which are directly electrically connected or indirectly electrically connected with other conductive elements, which is not limited herein. When the elastic conductor 136 is a sheet metal including the first elastic conductor 136a and the second elastic conductor 136b, which not only make the elastic conductor 136 with simple technological process, firm connection between the elastic conductor 136a and the second elastic conductor 136b, but also reduce the volume of the elastic conductor 136, save the material and the the raw material and technological cost. When the elastic conductor 136 is intergrated by directly electrically connecting the first elastic conductor 136a and the second elastic conductor 136b or indirectly electrically connected with other conductive elements, the elasticmember can be flexibly selected according to the requirements of the specific connecting components to optimize the internal design of the infusion mechanism module.

In the embodiment of the present invention, the frame 137 is further provided with a positioning post 138, the elastic conductor 136 is provided with an opening corresponding to the positioning post 138, and the elastic conductor 136 is sleeved on the positioning post 138 through the opening, so that the elastic conductor 136 is fixed to the frame 137. At the same time, the positioning post 138 is melted by hot melting to further fixed the elastic conductor 136 and to prevent the elastic conductor 136 from shaking due to long-term use or other reasons, which cause the poor electric connection between the elastic conductor 136 and the power supply 133 and the specific connection end on the circuit board (or three-dimensional circuit) and affect the use.

In the embodiment of the present invention, a boss 139 is also provided on frame 137. The boss 139 is located below the first elastic conductor 136a to prevent the protrusion 1361 of the first elastic conductor 136a from being flattened or deformed during long-term use, which results in a poor electrical connection between the first elastic conductor 136a and the specific connection end on the circuit board (or three-dimensional circuit), causing a malfunction. Preferably, the setting position of the boss 139 deviates from the projection position of the protrusion 1361 on the frame 137 and is close to the position post 138. On the one hand, it can prevent the circuit board from being damaged by hard contact or compression between the first elastic conductor 136a and the specific connection end on the circuit board (or three-dimensional circuit). On the other hand, it can ensure the elastic electrical contact between the first elastic conductor 136a and the specific connection end on the circuit board (or three-dimensional circuit).

Similar to the elastic conductive member above mentioned, the type of the elastic conductor 136

includes a conductive spring, a conductive leaf spring, a conductive rubber, a conductive silica gel, etc., which are not specifically limited herein, as long as they can meet the requirements for electrically connecting the power supply 133 to specific connection ends on the circuit board (or three-dimensional circuit). Preferably, in the embodiment of the present invention, the elastic conductor 136 is the conductive leaf spring. Since the infusion mechanism module 110 has a double-row battery pack, the multiple conductive leaf springs are also designed as a double-row pack, as shown in FIG.4a.

As shown in FIG.4a, the interior of the infusion mechanism module 110 also includes a drive unit 1310 and a power unit 1311, arranged on the frame 137. Frame 137 is also provided with a rotation shaft 1313, the drive unit 1310 is provided with a through hole, and the drive unit 1310 is sleeved on the rotation shaft 1313 through a through hole for fixing. The elastic conductor 136 can realize a direct electrical connection between the power supply 133 and the specific structural units, which helps to optimize the internal circuit design and reduce the complexity of the internal mechanism module. The driving unit 1310 includes a driving end 1312. One end of the power unit 1311 is connected to the driving unit 1310, and the other end is connected to a specific connection ends on the circuit board or three-dimensional circuit through the conductive platform 1314 so as to further realize the connection with the control module in the control mechanism module 100. The control module in the control mechanism module 100 applies power to the power unit 1311, the drive unit 1310 rotates around the rotation shaft 1313, drives the drive end 1312 forward to push the gear teeth of the drive wheel 134 forward, and causes the infusion device to perform drug delivery. In the embodiment of the present invention, there are two driving ends 1312 and two corresponding power units 1311. In another embodiment of the present invention, there is one driving end 1312 and one power unit 1311, as shown in FIG.4c.

The infusion mechanism module 110 is also provided with a conductive tower-spring 1315 sleeved on the rotating shaft 1313, with one end abuts the drive unit 1310, and the other end electrically connected to a specific connection end on the circuit board or three-dimensional circuit for fixing the drive unit 1310, at the same time, realize the electrical connection between the driving unit 1310 and specific connection ends on the circuit board or three-dimensional circuit.

FIG.6 is a schematic view of the conductive tower-spring according to an embodiment of the present invention.

In the embodiment of the present invention, the conductive tower spring 1315 includes a part A with a small diameter at the central part in the axial direction and a part B and a part C with a large diameter at both ends. The diameter of part A remains the same, and the rotation shaft 1313 is fixed by interference fit, further, fix the drive unit 1310, and at the same time, part B abuts the drive unit 1310 to prevent the drive unit 1310 from shaking due to instability when it is accidentally touched, causing the drive end 1312 to push the drive wheel 134 forward, which affects the accuracy of the infusion. The diameter of the B part and the C part gradually expand towards the two ends in a horn-like shape. When the B part and the C part are respectively electrically connected to the drive unit 1310 and the specific connection ends on the circuit board

or three-dimensional circuit, the conductive tower-spring 1315 is compressed; therefore, part B and part C have multiple turns, and at least 2-3 turns of springs are in contact with the driving unit 1310 and the specific connection ends on the circuit board or three-dimensional circuit at the same time, thereby improving the electrical connection reliability of the infusion device. Preferably, in the embodiment of the present invention, parts B and C of the conductive tower-spring 1315 are symmetrical, and the two ends can be assembled at will to avoid assembly misalignment.

FIG.7 is a partially enlarged view of the part M portion in FIG.4a according to the embodiment of the present invention.

In the embodiment of the present invention, at least one conductive platform 1314 is provided inside the infusion mechanism module 110. Specifically, when the driving unit 1310 includes two driving arms 1312, there are two corresponding power units 1311 and conductive platforms 1314, as shown in FIG. 4a. When the driving unit 1310 includes one driving arm 1312, there is one corresponding power unit 1311 and one conductive platform 1314, as shown in FIG. 4c. The conductive platform 1314 is electrically connected to the power unit 1311 and the specific terminal on the circuit board or three-dimensional circuit, respectively.

The conductive platform 1314 includes a conductive platform body 141 and a conductive arm 142. The conductive arm 142 is an elastic conductive element. At least one conductive platform protrusion 1421 is provided on the conductive arm 142 to facilitate the connection with specific connection ends on the circuit board (or three-dimensional circuit), improving the electrical connection reliability of the conductive platform 1314 and the specific connection ends on the circuit board (or three-dimensional circuit). When the conductive arm 142 of the conductive platform 1314 is flat, it is likely to cause the poor connection between the conductive platform 1314 and specific connection ends on the circuit board (or three-dimensional circuit) during use, thereby affecting the use effect. In the embodiment of the present invention, conductive platform protrusion 1421 may be a linear protrusion formed by bending conductive arm 142, or it may be several dots or other shapes of protrusions formed by other means on conductive arm 142. Here, the form, number, and forming method of conductive platform protrusion 1421 are not specifically limited, as long as the point contact connection or line contact connection between the conductive platform 1314 and the specific connection ends on the circuit board (or three-dimensional circuit) can be enhanced, improving the reliability of the electrical connection. In the embodiment of the present invention, the conductive platform body 141 further includes an end portion 1411 of the conductive platform body, and the power unit 1311 is an electric drive type linear driver or an electric heating type linear driver, such as a shape memory alloy, which is connected to the conductive platform body 141 by die casting, causing stable connection and highly reliable electrical connection. Specifically, the power unit 1311 is put into the end portion 1411 of the conductive platform body after being folded in half and then connected to the end portion 1411 of the conductive platform body 141 by die-casting method further improving the reliability of the electrical connection.

In the embodiment of the present invention, the conductive platform 1314 may be a sheet metal

including the conductive platform body 141 and conductive arm 142, or may be formed by the single conductive platform body 141 and the single conductive arm 142 directly electrically connected or indirectly electrically connected with other conductive elements, which is not limited herein. When the conductive platform 1314 is a sheet metal including the conductive platform body 141 and the conductive arm 142, which not only make the conductive platform 1314 with simple technological process, firm connection between the conductive platform body 141 and conductive arm 142, but also reduce the volume of the conductive platform 1314, save the material and the the raw material and technological cost.. When the conductive platform 1314 is integrated by the single conductive platform body 141 and the single conductive arm 142 directly electrically connected or indirectly connected with other conductive elements, the conductive member can be flexibly selected according to the requirements of the specific connecting components to optimize the internal design of the infusion mechanism module.

Similarly, the conductive platform body 141 and the conductive platform body end portion 1411 can also be sheet metal or integrated by directly or indirectly electrically connecting with other conductive elements, which is not limited herein. The conductive platform 1314 is a sheet metal including the conductive platform body 141, the conductive arm 142 and the conductive platform body end portion 1411, or the two of them can be a sheet metal and then integrated with the third party directly or indirectly through other conductive elements, or all of the three parts are directly integrated or indirectly integrated by electrical connection with other conductive elements, and there is no specific limitation here. The benefits of various forming methods are described above, so it will not be repeated here. Preferably, in the embodiment of the present invention, the conductive platform body 141, the conductive arm 142 and the conductive platform body end portion 1411 are integrally formed.

In the embodiment of the present invention, a plurality of stoppers 1316 are provided on the frame 137 for accommodating and limiting the position of the conductive platform 1314, the frame 137 is further provided with a conductive platform positioning post 1317, the conductive platform 1314 is provided with an opening corresponding to the conductive platform positioning post 1317, and the conductive platform 1314 is sleeved on the conductive platform positioning post 1317 through the opening, so that the conductive platform 1314 is fixed to the frame 137. At the same time, the conductive platform positioning post 1317 is melted by hot melting to further fixed the conductive platform 1314 and to prevent the conductive platform 1314 from shaking due to long-term use or other reasons, which cause the poor electric connection between the conductive platform 1314 and the power supply 133 and the specific connection end on the circuit board (or three-dimensional circuit) and affect the use.

In the embodiment of the present invention, a conductive platform boss (not shown) is also provided on the frame 137, and the conductive platform boss is located below the conductive arm 142 to prevent the conductive platform protrusion 1421 of the conductive arm 142 from being flattened or deformed during long-term use, which results in a poor electrical connection between the conductive arm 142 and the specific connection end on the circuit board (or three-dimensional circuit), causing a malfunction. Preferably, the setting position of the conductive platform boss deviates from the projection position of the conductive platform protrusion 1421 on the frame

137 and it is close to the conductive platform positioning post 1317. On the one hand, it can prevent the circuit board from being damaged by hard contact or compression between the conductive arm 142 and the specific connection end on the circuit board (or three-dimensional circuit). On the other hand, it can ensure the elastic electrical contact between the conductive arm 142 and the specific connection end on the circuit board (or three-dimensional circuit).

Similar to the elastic conductor 136 above mentioned, the type of the conductive platform 1314 includes a conductive spring, a conductive leaf spring, a conductive rubber, a conductive silica gel, etc., which are not specifically limited herein, as long as they can meet the requirements for electrically connecting the power unit 1310 to specific connection ends on the circuit board (or three-dimensional circuit).

FIG.8a and FIG.8b are schematic views of the driving wheel assembly and the frame before and after assembly according to the embodiment of the present application embodiment, respectively. FIG.8c is a schematic view of the shield according to an embodiment of the present invention.

The driving wheel assembly includes a driving wheel body 16 and a movable block 18. The driving wheel body 16 includes a driving wheel 161, a driving tube 162, which is provided with threads for accommodating the screw 135, and a connecting piece 163 arranged at the end of the driving wheel 161. The connecting piece 163 is provided with a connecting portion 1631, operatively connected with the movable block 18. The movable block 18 is provided with threads to accommodate the screw 135. The movable block 18 is also provided with a movable block connecting rod 181, which is mobily connected with the connecting portion 1631. After the connecting rod 181 is mobily connected with the connecting portion 1631, the movable block 18 can rotate around the connecting rod 181 to open or close the movable block 18. When the movable block 18 is opened, the screw 135 can slide to the driving wheel body 16, and when the movable block 18 is closed, the screw 135 cannot slide to the driving wheel body 16, which will be described in detail below.

The driving wheel assembly further includes a shield 15, and a plurality of shield engaging portions 151 are provided on the shield 15 for engaging with the frame 17. The frame 17 is provided with a frame groove 171 for accommodating the driving wheel body 16 and a plurality of frame engaging portions 172 for engaging with the shield engaging portions 151. After the driving wheel body 16 and the movable block 18 are connected and put into the frame groove 171, the shield 15 is assembled to the frame 17. By the engagement of the frame engaging portion 173 and the shield engaging portion 151, the driving wheel body 16 and the movable block 18 are fixed in the frame 17 to prevent the shaking of the driving wheel assembly and affect the accuracy of drug infusion.

The frame engaging portions 173 and the shield engaging portion 151 include hooks, blocks, holes, and grooves that can be engaged with each other. The position of the engaging portions can be flexibly designed according to the shape and design of the frame 17 and the shield 15, and is not specifically limited here. Preferably, the space formed by the plurality of frame engaging portions 173 and the plurality of shield engaging portions 151 can accommodate the driving wheel body 16 and the movable block 18 to prevent the driving wheel body 16 from shaking.

In the embodiment of the present invention, the shield 15 is also provided with at least one elastic arm 152 for elastically abutting the drive tube 162, which can further fix the drive wheel body 16, improving the stability of the infusion mechanism module 110 and the accuracy of drug infusion. Preferably, two elastic arms 152 are arranged on both sides of one of the driving wheels 161 and abut against the driving tube 162, respectively. As shown in FIG. 8b, the driving wheel body 16 is fixed at multiple points.

The shield 15 is also provided with a baffle 153, and the baffle 153 is provided with a mouth. The main frame 17 is also provided with a card slot 173 on the side close to the reservoir 131 for accommodating the strip (not shown). The strip abuts against the baffle 153 to form a through hole for accommodating the screw 135 and at the same time confine the driving wheel body 16 and the movable block 18 in the frame 17. Preferably, the mouth of the baffle 153 is semi-circular, and the diameter is adapted to the diameter of the screw 135, so as to better accommodate the screw 135 and prevent the screw 135 from shaking greatly under the action of external force.

Preferably, in the embodiment of the present invention, the shield 15 is integrally molded; the technological process is simple, the the volume is small, the connection is firm, the material is saved, and the cost is reduced.

FIG.9a-FIG.9d are schematic views of the movable block opened or closed according to an embodiment of the present invention, respectively.

The movable block 18 further includes an upper movable block 182 and a lower movable block 183, and the lower movable block 183 is also provided with a lower movable block end 1831. The movable block 18 opened means that the upper movable block 182 is close to the driving wheel 161, and the lower movable block 183 is far away from the driving wheel 161. The thread in the movable block 18 does not engage with the screw135. The screw135 can be smoothly slid in the movable block 18 and the driving tube 162. The movable block 18 closed means that the upper movable block 182 is far away from the driving wheel 161, and the lower movable block 183 is close to the driving wheel 161. At this time, the thread in the movable block 18 is engaged with the screw rod 135, and the screw 135 cannot slide in the movable block 18 and the driving tube 162.

In the embodiment of the present invention, an arc-shaped blocking member 174 is also provided on the frame 17 to limit the position of the lower movable block 183. When the movable block 18 is opened, that is, the upper movable block 182 is close to the driving wheel 161 and the lower movable block 183 is far away from the driving wheel 161, the lower movable block end 1831 of the lower movable block 183 is located outside the arc-shaped blocking member 174, so that the movable block 183 is kept open. At this time, the thread in the movable block 18 does not engage with the screw 135, and the screw 135 can slide smoothly in the movable block 18 and the drive tube 162. When the movable block 18 is opened, the reservoir 131 can be filled with the drug. In the filling process to the reservoir 131, the screw 135 can smoothly move to the end of the driving wheel 161 under the pushing action generated during the filling process, until the filling is completed, no need for the assistance of other parts, which can simplify the complexity of the infusion mechanism module, improve the integration level, save cost, and reduce the volume of

the infusion mechanism 110, and at the same time maximizing the actual storage volume of reservoir 131.

When the movable block 18 is closed, that is, the movable block 182 is far away from the driving wheel 161 and the lower movable block 183 is close to the driving wheel 161, the lower movable block end 1831 of the lower movable block 183 is located inside the arc-shaped blocking member 174, and the movable block 18 is kept closed. At this time, the thread in the movable block 18 is engaged with the screw 135, and the screw 135 cannot slide in the movable block 18 and the drive tube 162. When the infusion device 110 performs the drug infusion after the drug is filled, the driving end 1312 of the driving unit 1310 pushes the driving wheel 161 forward, and the movable block 18 rotates with the driving wheel 161. During the rotation, after the lower movable block end 1831 bypasses the arc-shaped blocking member 174, since there is no resistance from the arc-shaped blocking member 174, the lower movable block end 1831 falls into the inside of the arc-shaped blocking member 174. At the same time, since the movable block 18 is kept closed, the screw 135 can only move away from the driving wheel 161 under the pushing action of the rotation of the driving wheel 161 and perform the drug infusion. There is no need to worry about the free movement of the screw 135 due to the engagement failure of the screw 135 with the movable block 18 or the drive tube 162, which will affect the infusion effect or even cause the infusion device to disable.

In the embodiment of the present invention, a notch 1611 is provided on the end face of the driving wheel 16, close to the reservoir 131, the shape is adapted to the lower movable block 183, and is used for accommodating the lower movable block 183. When lower movable block end 1831 bypasses the arc-shaped stopper 174 and falls into the inside of the arc-shaped stopper 174, the lower movable block 183 is accommodated in the notch 1611 of the driving wheel 161, making full use of the space of the driving wheel body, optimizing the internal design of the infusion mechanism module to reduce the volume of the infusion device.

It should be noted here that "inside" and "outside" are relative to the arc-shaped blocking member 174, and belong to the concept of relative position. The positional relationship is as shown in FIG. 9b and FIG. 9d.

FIG.10a a schematic view of the adhesive patch according to an embodiment of the present invention. FIG.10b a schematic view of each layer of the adhesive patch according to an embodiment of the present invention. FIG.10c is a schematic view of the cascading sequence of the adhesive patch according to an embodiment of the present invention. FIG.10d a schematic view of each layer of the adhesive patch with multiple tapes according to an embodiment of the present invention. FIG.10e a schematic view of the cascading sequence of the adhesive patch with multiple tapes according to an embodiment of the present invention.

Adhesive patch 120 comprises a tape 1201, the first side α of the tape 1201 is firmly connected to the infusion mechanism module 110, and the second side β is coated with paste material for pasting the infusion device to the host skin surface. The material of the tape 1201 is one of the following: polyethylene, polypropylene, non-woven or cotton. The tape 1201 is in direct contact with the skin of the host. According to the actual use environment, the above materials can avoid

the adverse reactions caused by the tape 1201 contacting the skin for a long time. In order to adapt to the host skin movement, such as tortuous, stretching, etc., the thickness of the tape 1201 is extremely thin, for example, about 1um ~500um. Thin tape can cause other problems, such as static electricity from the host skin, or intense skin movement can cause the edges of the tape to warp. Once the edge of the tape warps, the area of the warped edge of the tape 1201 will gradually increase with the increase of the use time, resulting in the decrease of the adhesion force between the tape 1201 and the skin, which may lead to the displacement or shedding of the infusion device, affecting the user experience.

A protective film 1202 is added on the outer edge of the first α face of the tape 1201, and the rockwell hardness of the protective film 1202 is greater than that of the tape 1201. Preferably, in the embodiment of the invention, the rockwell hardness of the protective film 1202 is 80HRM ~100HRM.

Preferably, in the embodiment of the invention, the protective film 1202 is one of polycarbonate, polyamide, polyformaldehyde, polyphenyl ether, polyester, polyphenylene sulfide and polyaryl ester.

In a more preferred embodiment of the invention, the protective film 1202 is polyethylene terephthalate (PET), and its rockwell hardness is 90 HRM~95HRM.

The outer contour of the protective film 1202 is compatible with the outer contour of the tape 1201. Here, the outer contour size, bending radius, shape and other parameters of the protective film 1202 are consistent with the outer contour parameters of the tape 1201, so that every part of the outer contour of the tape 1201 can be fitted with the protective film 1202.

In the preferred embodiment of the invention, the thickness of the protective film is 10um ~500um.

In the preferred embodiment of the invention, the protective film 1202 is annular; the hollow and annular protective film 1202 can be fitted to the first side α of the tape 1201 comprehensively, and no interference with the infusion device. Secondly, the inner contour of the annular protective film is consistent with the outer contour, which is more beautiful and enhances the user experience.

In the embodiment of the invention, the tape 1201 is provided with a first through hole 12011, and the position of the first through hole 12011 corresponds to the infusion needle 121 of the infusion device, which is used for the infusion needle 121 to pierce the skin of the host.

The second side β of the tape 1201 is also provided with at least one layer of release paper 1203, as the release paper 1203 can prevent the adhesive material of the second side β of the tape 1201 from adhering and can contaminating.

In the preferred embodiment of the invention, the release paper 1203 is a single silicon release paper, and its peeling force is 30g~50g.

In the embodiment of the invention, the release paper 1203 is provided with a second through hole 12031, and the position of the second through hole 12031 corresponds to the first through

hole 12011, so that the infusion needle 121 of the infusion device can pass through the first through hole 12011 and the second through hole 12031 to pierce the host skin.

For the convenience of users to peel off release paper 1203 and tape 1201, and save space, the release paper 1203 is preferred to be two layers, and the peel openings are relative to each other, and the peel openings of one layer are bent outwardly and covered by the peel openings of the other layer. Combined with the above, adhesive patch 120 from side α to β is protective film 1202, tape 1201 and release paper 1203 in sequence.

In another embodiment of the present invention, the adhesive patch includes at least two layers of tape. Except that the first layer of tape is fixedly connected to the lower case of the infusion device, the other layers of tape are laminated and sleeved on the infusion device, through the relay action of the the tapes, the infusion device can be stick to the surface of the user's skin for a long time, prolonging the use time of the infusion device. The outer contour of the outer tape (away from the skin) completely covers the outer contour of the inner tape (closer to the skin). It should be noted that the complete coverage includes the outer contour of the outer tape and the inner tape are complete overlaped, that is, the areas of the inner and outer tapes are equal, and it also includes the outer contour of the outer tape extends outward along the outer contour of the inner tape, that is, the area of the outer tape is larger than the area of the inner tape.

It should be further explained that, except for the first layer of tape, the remaining layers are all overlaid on the infusion device. Therefore, in the embodiments of the present invention, unless otherwise specified, the “Cover” or “Area” mentioned in the specification is refers to the relationship or area of the inner and outer tapes protruding from the infusion device.

When the outer tape completely covers the adjacent inner tape, after tearing off the outer tape, the exposed inner tape is in a brand new state, free of dirt, improving user experience. Preferably, the area of the outer tape is greater than the area of the adjacent inner tape. Because the outer tape is curled, warped or contaminated first, after tearing off the outer tape, it can be ensured that the exposed inner tape is in a brand new state, further improving the user experience.

In another embodiment of the present invention, the outer tape at least partially covers the inner tape, and the at least partial cover mentioned here includes the outer contour of the inner tape completely protruding from the outer contour of the outer tape. At this time, although the outer contour of the inner tape will be curled or warped to a certain extent first, when the position of the curled or warped edge extends to the position where the outer tape overlaps, the inner tape will stop or suspend warping or curling due to the protective of the outer tape, so as to extend the use time of the infusion device.

At least partially covers also includes that the inner and outer tapes have a part of the outer contour protruding from each other. As mentioned above, when the part of the outer contour of the outer tape protruding from the outer contour of the inner tape curled or warped first, after tearing the outer tape, the part of the inner tape corresponding to the outer layer is in a new state; and when the part of the outer contour of the inner tape protrudes from the outer contour of the outer tape curled or warped first and extend to the position where the outer tape overlaps, the

inner tape will stop or suspend warping or curling due to the protective of the outer tape. In both cases, the use time of the infusion device can be extended to a certain extent.

The adhesive patch also includes a layer of protective film, which is set on the outermost layer of tape. The outer contour is compatible with that of the outermost layer of tape to prevent curling or warping of the outermost layer of tape and further extend the use time of the infusion device.

In another embodiment of the present invention, the adhesive patch 120 includes a plurality of tapes and a plurality of protective films, and every two tapes are separated by a protective film to prevent adhesion between adjacent tapes. At the same time, it is convenient to separate the tapes. The tape of the same layer is compatible with the outer contour of the protective film, as shown in FIG.10d and FIG.10e, the third tape 1205 and the third protective film 1206 have the same outer contours, and the areas are equal; the second tape 1203 and the second protective film 1204 have the same outer contours, and the areas are equal. The “compatible with” mentioned here means that the outer contour size, bending radius, shape and other parameters of the protective film are consistent with the outer contour parameters of the tape, so that every part of the outer contour of the tape can be attached to the protective film.

In the process of use, when the outermost protective film, that is, the third protective film 1206, loses its protective effect due to falling off and other reasons, tear off the third protective film 1206; continue to use for a period of time, when the outermost tape is curled or wraped, that is, when the third tape 1205 is curled or waped, tear off the second protective film 1204 and the third tape 1205 together, and the second tape 1203 is exposed. Continue to use for a period of time, when the second tape 1203 is curled or waped, tear off the first protective film 1202 and the second tape 1203 together, the first tape 1201 is exposed, extending the time that the infusion device is stabilized sticked on the surface of the user’s skin and improving the user experience. Through the relay of multiple tapes and the protection of the protective films, the infusion device is stuck on the surface of the user's skin for a long time, prolonging the use time of the infusion device.

It should be noted that in the embodiment of the present invention, the multiple tapes and the multiple protective films are not limited to three layers, they may be two layers, or more layers, and they can be choosed according to the requirements of the infusion device need to past on the surface of the user. The outermost layer also can not be provided with a protective film, and the use time of the infusion device can also be prolonged through the layer-by-layer relay of the tapes. Preferably, the outermost layer is provided with a protective film, which can prevent curling or warping of the outermost tape, and further prolong the use time of the infusion device.

It should also be noted that the position and size relationship of the adjacent inner and outer tapes and protective films are consistent with the aforementioned multilayer tapes without protective film, that is, the outer contour of the outer tape and the protective film can completely cover the inner tape or can at least partially cover the outer contour of the inner tape and the protective film. The corresponding beneficial effects are also as described above. At the same time, since there is a protective film between every two tapes, when the areas of the inner and outer tapes and the protective film are not equal, when the outer tape is torn off through the inner protective film, the

difference in area between the inner and outer protective film and the tape can be used to easily tear off the inner protective film and outer tape without affecting the inner tape.

In the embodiment of the present invention, the protective film is also provided with at least one tearing portion, as shown by 12021, 12041 and 12061 in FIG.10d, such as notches, perforated tear lines, or break seams, etc., to facilitate separating the protective film from the inner tape and tear off the outer tape at the same time. Preferably, 2-3 tearing portion s are provided on the inner protective film to facilitate tearing off the protective film and the adjacent outer tape from different positions, so as not to affect the inner tape. There is only one tearing portion on the outermost protective film, which not only facilitates the tearing of the outermost layer of adhesive tape, but also prevents the outermost tape from curling or warping to the maximum extent and prolongs the use time of the infusion device. It should be noted that the specific form of the tearing portion is not limited in the embodiment of the present invention, as long as the outer tape can be easily torn off.

In another embodiment of the present invention, no tearing part is provided on the outermost protective film to prevent users from habitually tearing off the outermost protective film, or opening the outermost protective film or falling off from the outermost tape due to accidental touch, which will lose its protective effect on the outermost tape.

In the embodiment of the present invention, except that the first tape is pasted on the lower case of the infusion device, and the area is adapted to the area of the lower case of the infusion device, the adaptation mentioned here refers to the first tape can cover the area of the lower case, and at the same time extend from the outer contour to a certain distance, so that the infusion device can better stick to the skin. Other tapes and protective films are annular, laminated and sleeved on the infusion device, and do not interfere with the infusion device. In addition, the inner and outer contour of the annular tapes and protective films are consistent with each other, which is more beautiful and Cn enhance the user experience.

In the embodiment of the present invention, the materials of each tape and protective film are as described above, and will not be repeated here. The materials of each tape and protective film can be the same or different, and it can be selected according to actual needs.

FIG.11a and FIG.11b are schematic views of the control mechanism module and infusion mechanism module according to another embodiment of the present invention.

In the embodiment of the present invention, the main difference with the control mechanism module 100 and the infusion mechanism module 110 (as shown in FIG.2 and FIG.3) is that the control mechanism module 200 includes a first electrical connection 203 and a first physical component 223, the infusion mechanism module 210 includes a second electrical connection 213 and an in-position detection module 222, which will be described in detail below. The other parts are the same as the aforementioned control mechanism module 100 and the infusion mechanism module 110, here will not be repeated.

The second electrical connection 213 and in-position detection module 222 are both arranged on the convex portion 214 of the upper case 211 of the infusion mechanism module 210, which can

make the full use of the internal space of the infusion device and optimize the circuit layout of the circuit board or three-dimensional circuit set up. In other embodiments of the invention, the second electrical connection 213 and in-position detection module 222 may also be arranged at other positions of the infusion mechanism module 210, which are not limited here.

The in-position detection module 222comprises a second physical component 2221, such as a voltage variant resistance device, a magnetic part, an inductor coil, a capacitor, etc, is understood by technical personnel in this field that the physical components mentioned above can also be combined. In addition, the physical components that can be used by the in-position detection module 222 are not limited to this, and other physical components that can trigger position signals can be used here. The first physical component 223 is electrically operable, with the second physical component 2221. The "operable" electrical connection here means that the first physical component 223 and the second physical component 2221 have different electrical connections according to the type of the first physical component 223 and the second physical component 2221.

FIG.12b is a schematic view of the in-position detection module comprising a magnetic component according to an embodiment of the invention.

In the embodiment of the present invention, the second physical component 2221 of the in-position detection module is a voltage variant resistance device, which is sensitive to pressure, and the change of the external device's pressure on the voltage variant resistance device can cause the change of the resistance value of the voltage variant resistance device, which can be linear or nonlinear. This principle can be used to detect the firmness of the combination between control mechanism module 200 and infusion mechanism module 210.

The second physical component 2221 is a voltage transformer device located on the convex portion 214 of the infusion mechanism module 210, and the corresponding first physical component 223 on the control mechanism module is a rigid electrical contact point. The rigid electrical contact point contacts with the voltage transformer device when the control mechanism module is installed on the infusion mechanism module. Technicians in this field know that to form a closed-loop circuit, the number of rigid electrical contact points is two, namely the first rigid electrical contact point 223a and the second rigid electrical contact point 223b.

In the embodiment of the invention, when the control mechanism module and the infusion mechanism module are normally connected, the rigid electrical contact point contacts with the voltage variant resistance device to generate a base pressure F1, and corresponding to the base pressure, the voltage variant resistance device generates a base resistance R1. When the connection between the control mechanism module and the infusion mechanism module becomes loose and lost its position, the pressure generated by contact between the rigid electrical contact point and the voltage variant resistance device decreases, for example to F2, apparently F2<F1, corresponding pressure variable resistance device resistance R2, if the voltage variant resistance device is a positive feedback device, the R2<R1, on the contrary, if the voltage variant resistance device is a negative feedback device, the R2>R1. When the connection between the control mechanism module and the infusion mechanism module becomes tight, the pressure generated by

contact between the rigid electrical contact point and the varistor device is increased, for example, change to F3, obviously the F3>F1, correspondingly, the resistance of the pressure variable resistance device changes to R3, if the voltage variant resistance device is a positive feedback device, the R3>R1, on the contrary, if the voltage variant resistance device is a negative feedback device, the R3<R1.

Whether the voltage transformer device is a positive feedback device or a negative feedback device, there is a unique correspondence between the resistance value and the pressure, and the pressure is positively correlated with the firmness of the combination between the control mechanism module and the infusion mechanism module, so the resistance value of the voltage variant resistance device indirectly represents the firmness of the combination between the control mechanism module and the infusion mechanism module.

In the preferred embodiment of the invention, the resistance value R of the voltage variant resistance device is converted into the relative position data between the control mechanism module and the infusion mechanism module after being calculated by the relevant algorithm, and then transmitted wirelessly by the control mechanism module to a remote device, such as PDM(Personal Diabetes Manager), mobile terminal, etc., it is convenient for users to know the tightness of the installation of the control mechanism module in real-time.

In the preferred embodiment of the invention, the voltage variant resistance device is a voltage variable resistance conductive rubber strip. The voltage variable resistance conductive rubber strip is easy to cut and can be processed into any shape to meet the testing device's structural design requirements.

FIG.12b is a schematic view of the in-position detection module comprising a magnetic component according to an embodiment of the invention.

In the embodiment of the invention, the second physical component 4231 of the in-position detection module is a magnetic component, which provides a stable magnetic field. At different effective distances, magnetic components have different magnetic field directions and magnetic field strengths. This principle can be used to detect the firmness of the combination between the control mechanism module and the infusion mechanism module.

The second physical component 4231 is the magnetic component, and the corresponding first physical component 222 on the control mechanism module is the magnetic sensor. When the control mechanism module is mounted on the infusion mechanism module, the magnetic sensor inducts either the magnetic field direction or the magnetic field strength of the magnetic component, or both. The direction or strength of the induced magnetic field varies with the distance O between the magnetic sensor and the magnetic component. Preferably, the magnetic field strength H of the magnetic component is induced by the magnetic sensor.

In the embodiment of the invention, when the control mechanism module is normally connected to the infusion mechanism module, the distance between the magnetic sensor and the magnetic component is O1, and the magnetic sensor senses the basic magnetic field strength H1 of the magnetic component. When the connection between the control mechanism module and the

infusion mechanism module becomes loose and loses position, the distance between the magnetic sensor and the magnetic component becomes larger, for example, O2, O2>O1, and the magnetic field strength of the magnetic component induced by the corresponding magnetic sensor becomes H2, obviously H2<H1. When the connection between the control mechanism module and the infusion mechanism module becomes tight, the distance between the magnetic sensor and the magnetic component becomes smaller, for example, O3, there O3<O1, and the magnetic field strength of the magnetic component that the corresponding magnetic sensor becomes H3, obviously H3>H1.

No matter how the distance O between the magnetic sensor and the magnetic component changes, there is a unique correspondence between the distance O and the magnetic field strength H, and the distance between the magnetic sensor and the magnetic component is related to the firmness of the control mechanism module and the infusion mechanism module, so the magnetic field strength H of the magnetic component induced by the magnetic sensor indirectly represents the firmness of the combination of the control mechanism module and the infusion mechanism module.

In the preferred embodiment of the invention, the magnetic field strength H of the magnetic component induced by the magnetic sensor is converted into the relative position data between the control mechanism module and the infusion mechanism module after the relevant algorithm operation, and then transmitted wirelessly to the remote device, such as PDM(Personal Diabetes Manager), mobile terminal, etc., by the control mechanism module 200. It is convenient for users to know the tightness of installing the control mechanism module in real-time.

FIG.12c is a schematic view of the in-position detection module comprising an inductor coil according to an embodiment of the invention.

In the embodiment of the invention, the second physical component 5231 of the in-position detection module is an inductor coil, and the following formula can calculate the inductance value L of the inductor coil:

$$L = \frac{0.01 * D * N^2}{\frac{l}{D} + 0.44}$$

In the formula,

D is the diameter of the inductor coil;

l is the length of the inductor coil;

N is the number of turns of the inductor coil.

For the same inductor coil, its diameter D and the number of turns N will not change, and the length l can vary depending on the extrusion force or the tensile force at both ends; when the length l changes, its inductance value L will also change. This principle can be used to detect the firmness of the combination between the control mechanism module and the infusion mechanism module.

The second physical component 5231 comprises an inductor coil 5231a and a conductive boss 5231b. The conductive boss 5231b is located on the convex portion 414, and the inductor coil 5231a is electrically connected with the conductive boss 5231b. Correspondingly, the first physical component 423 on the control mechanism module comprises a pressing part 423a in contact with one end of the inductor coil and an elastic electrical contact point 423b electrically connected with the other end of the inductor coil through conductive boss 3142b. What technicians in this field can know is that in order to obtain the inductance value L of the inductor coil, the conductive boss 5231b, the pressing part 423a and the elastic electrical contact point 423b are all conductive materials.

In the embodiment of the invention, when the control mechanism module is normally connected to the infusion mechanism module, the pressing part 423a contacts with one end of the inductor coil, and the elastic electrical contact point 423b contacts with the other end of the inductor coil. The pressing part 423a, the inductor coil and the elastic electrical contact point 423b form a closed circuit, and the internal circuit in the control mechanism module can obtain the inductance value L of the inductor coil. At this time, the distance between the control mechanism module and the infusion mechanism module is s1, the length of the inductor coil is l1, corresponding to the length of the inductor coil, the basic inductance value of the inductor coil is l1. When the connection between the control mechanism module and the infusion mechanism module becomes loose and loses position, the distance between the control mechanism module and the infusion mechanism module becomes s2, the pressing part 423a moves with the control mechanism module, the length of the inductor coil becomes l2, s2>s1, l2>l1, and the inductance value of the inductor coil becomes L2, obviously L2<L1. When the connection between the control mechanism module and the infusion mechanism module becomes tight, the distance between the control mechanism module and the infusion mechanism module becomes s3, and the pressing part 423a moves with the control mechanism module, the length of the inductor coil becomes l3, s3<s1, l3>l1. At this time, the inductance value of the inductor coil becomes L3, obviously L3>L1. Regardless of the distance between the control mechanism module and the infusion mechanism module, the elastic electrical contact 423b can maintain good electrical contact with the inductor coil because of its elastic property unless the control mechanism module is completely removed from the infusion mechanism module.

No matter how the length l of the inductor coil changes, there is a unique correspondence between the length l and the inductor value L, while the length l of the inductor coil is related to the firmness of the combination between the control mechanism module and the infusion mechanism module. Therefore, the inductance value L of the inductor coil indirectly represents the firmness of the combination between the control mechanism module and the infusion mechanism module.

In the preferred embodiment of the invention, the inductance value L of the inductor coil is converted into the relative position data between the control mechanism module and the infusion mechanism module after being calculated by the relevant algorithm, and then transmitted wirelessly to a remote device, such as PDM(Personal Diabetes Manager), mobile terminal, etc. It is convenient for users to know the tightness of installing the control mechanism module in

real-time.

FIG.12d is a schematic view of the in-position detection module comprising a capacitive lower plate according to an embodiment of the invention.

In the embodiment of the invention, the second physical component 5221 of the in-position detection module comprises a lower electrode plate of the capacitor, and the first physical component 523 comprises an upper electrode plate 523a of the capacitor and an elastic electrical contact 523b. The combination between the upper electrode plate 523a and the lower electrode plate is a complete capacitor, and the elastic electrical contact 523b is used to make electrical contact with the lower electrode plate to form a closed circuit. An internal circuit in the control mechanism module can measure the capacitance value C of the capacitor. The following formula can determine the capacitance value C:

$$C = \frac{\varepsilon * S}{4 \pi kd}$$

In the formula,

ε is a constant;

S is the frontal area of the capacitor's upper and lower plates;

K is the electrostatic force constant;

D is the distance between the upper and lower plates of the capacitor.

For the capacitance composed of the upper and lower plates, the positive area S and the static power constant ε are fixed, and the distance d between the upper and lower plates can change with the firmness of the combination between the control mechanism module and the infusion mechanism module. When the distance D changes, the capacitance C will also change. This principle can be used to detect the firmness of the combination between the control mechanism module and the infusion mechanism module.

As mentioned above, the first physical component 523 comprises a capacitive upper plate 523a and an elastic electrical contact 523b. The combination between the upper plate 523a and the lower plate is a complete capacitor, and the elastic electrical contact 523b is used to make electrical contact with the lower plate to form a closed circuit. Technicians in this field can know that elastic electrical contact 523b is a conductive material in order to obtain a capacitance value.

In the embodiment of the invention, the control mechanism module and the infusion mechanism module are normally connected, the upper plate 523a and the lower plate form a capacitor, elastic electrical contact 523b is in contact with the lower plate and is used to provide the lower plate with a charge opposite to the upper plate 523a, the distance between the upper plate 523a and the lower plate is d1, corresponding to the upper and lower plate distance, the capacitance of the capacitor is C1. When the connection between the control mechanism module and the infusion mechanism module becomes loose and loses position, the distance between the control

mechanism module and the infusion mechanism module becomes d2, d2>d1, and the capacitance value of the capacitor becomes C2, obviously C2<C1. When the connection between the control mechanism module and the infusion mechanism module becomes tight, the distance between the control mechanism module and the infusion mechanism module becomes d3, d3<d1, and then the capacitance value of the capacitor becomes C3, obviously C3>C1. Regardless of the distance between the control mechanism module and the infusion mechanism module, elastic electrical contact 523b can maintain good electrical contact with the inductor coil because of its elastic property unless the control mechanism module is completely removed from the infusion mechanism module.

No matter how the distance d between the upper and lower plates of the capacitor changes, there is a unique corresponding relationship between the distance d and the capacitance value C, while the distance d between the upper and lower plates is related to the firmness of the combination between the control mechanism module and the infusion mechanism module. Therefore, the capacitance value C of the capacitor indirectly represents the firmness of the combination between the control mechanism module and the infusion mechanism module.

In the preferred embodiment of the invention, the capacitance value of the capacitor is converted into the relative position data of the control mechanism module and the infusion mechanism module after the relevant algorithm operation and then transmitted wirelessly to the remote device, such as PDM(Personal Diabetes Manager), mobile terminal, etc., so that the user can understand the installation tightness of the control mechanism module in real-time.

In the embodiment, the internal circuit is also provided with a signal threshold interval of the control mechanism module normally in position. FIG.13 is a schematic view of the threshold interval of a normal in-position signal according to an embodiment of the invention. The in-position detection module may be one or more combinations of voltage transformer devices, inductor coils, magnetic components or capacitors. The parameter signals and the bonding degree of the control mechanism module and the infusion mechanism module may be linear or nonlinear, and may be positive feedback or negative feedback. Whatever the relationship, the parameter signal is uniquely corresponding to the firmness of the bond between the control mechanism module and the infusion mechanism module, and thus the parameter signal has a unique maximum threshold and a unique minimum threshold, the interval between the above maximum threshold and minimum threshold is the normal in-place threshold interval, during which the control mechanism module is properly fixed to the infusion mechanism module.

If the parameter signal exceeds the normal in-position threshold range, it indicates that the control mechanism module is loose, or the control mechanism module is too tightly combined with the infusion mechanism module due to external extrusion. At this time, the internal circuit sends out an alarm signal, prompting the user to press the control mechanism module, or replace the control mechanism module, or cancel the external pressure.

In order to meet the needs of different users, the expression form of an alarm signal can be designed as one or more combinations of luminous signal, vibration signal and sound signal.

FIG.14 is a schematic view of the internal mechanism module of the infusion mechanism module comprising a blockage detection module according to another embodiment of the present invention.

In the embodiment of the present invention, the infusion device is also provided with a blockage detection module, which is operably connected to the control mechanism module, and is used to sense and measure related physical parameters during the drug filling process or the drug infusion process to confirm whether a blockage has occurred. The blockage detection module includes a detection circuit (not shown) and at least one detection element 311. The detection circuit is arranged in the control mechanism module, and the detection element 311 is arranged in the infusion mechanism module 310. The detection circuit cooperates with at least one detection element 311 to provide corresponding signals, data or information that need to be analyzed and processed for the purpose of blockage detection. The detection circuit also stores preset thresholds for various related physical parameters, and includes a comparator that compares the sensed related physical parameters with the preset thresholds. When the sensed related physical parameters are greater than or less than the corresponding preset thresholds, the detection circuit sends out an alarm signal to remind the user that the blockage occurs, stop the infusion, replace the infusion mechanism module, or perform other operations to avoid potential safety hazards.

In an embodiment of the present invention, the detection element 311 is a component of the infusion device itself, the power unit 313, preferably, the power unit 313 is an electric driven linear drive or electric heating driven linear drive, such as a shape memory alloy. A timer is set in the detection circuit to record the time it takes for the power unit 313 to pull the drive end 314 to push the drive wheel 315 to rotate and then to push the piston 312 forward by one step. When the time for the piston 312 moving forward by one step is greater than a certain preset, the detection circuit sends out an alarm signal to remind the user that a blockage occurs. In the embodiment of the present invention, the power unit is a component of the infusion device itself. Using this component as a detection element can optimize the internal arrangement of the infusion device and reduce the cost.

In other inventive embodiments of the present invention, the detection element 311 is a component of the non-infusion device itself, such as one or a combination of a force sensor, an acceleration sensor, and a position detection element. As shown in FIG.14, the detection element 311 is provided in the piston 312. In other embodiments of the present invention, the detection element 311 may also be provided in other parts of the infusion mechanism module 310, such as one or more places in the screw 316, or the connection point of the screw 316 and the piston 312 etc., which are not limited here. It can be flexibly set according to the actual arrangement to optimize the internal design of the infusion mechanism module.

In another embodiment of the present invention, the detection element 311 is a force sensor, preferably, the force sensor is a tension sensor. During the drug filling or infusion process, the tension sensor is used to sense the force of the power unit 313 acting on the screw 316 or the piston 312, when the sensed force is greater than a certain preset threshold, the detection circuit sends out an alarm signal to remind the user that a blockage occurs.

In one embodiment of the present invention, the detection element 311 is a force sensor, preferably, the force sensor is a pressure sensor. During the drug filling or infusion process, the pressure sensor senses the pressure applied by the piston to the drug. When the sensed pressure exceeds a certain preset threshold, the detection circuit sends out an alarm signal to remind the user that a blockage occurs.

In another embodiment of the present invention, the detection element 311 is an acceleration sensor. During the drug filling or infusion process, the acceleration sensor can sense the speed or acceleration of the screw 315 or the piston 312 moving in the reservoir 313. The detection circuit converts it into the change value of speed or acceleration per unit time. When the detected change value is less than a certain preset threshold, the detection circuit sends an alarm signal to remind the user that the blockage occurs.

In another embodiment of the present invention, the detection element 311 is a position detection element. During the drug filling or infusion process, the position detection element detects the position changes of the end of the piston 312 or the screw 136 in the reservoir 317 along the axial direction (the moving direction of the screw 136), the detection circuit converts the axial position information of the piston 312 or the end of the screw 136 into the speed or acceleration of the piston 312 or the end of the screw 136 moving in the reservoir 317 in a unit time and further calculates the change value of the speed or acceleration of the piston 312 or the end of screw 136. When the change value is less than a certain preset threshold, the detection circuit sends an alarm signal to remind the user that the blockage occurs.

Preferably, in the embodiment of the present invention, the position detection element detects the position of the end of the piston 312 or the screw 136 by a non-contact detection method. The position detection element is a magnetic element for providing a magnetic field. The detection circuit is provided with a magnetic sensor. The magnetic field intensity of the magnetic element induced will be changed with the change of the position of the magnetic element, that is, the end of the piston 312 or the screw 136. Therefore, the detection circuit can calculate the position change of the piston 312 end or the screw 136 through the change of the induced magnetic field. As described above, the blockage can be detected by the further calculation of the detection circuit. In other embodiments of the present invention, the position detection element can also detect the position of the end of the piston 312 or the screw 136 by other non-contact or contact detection methods, which is not specifically limited herein.

Preferably, in the embodiment of the present invention, the detection element 311 is provided in the piston 312, and the piston 312 is provided with at least one recess 3121 for accommodating the detection element 311. The recess 3121 is also provided with a plurality of projects 3122, for fixing the detection element 311. A positioning portion 3123 is further provided in the middle of the recess 3121 to fix the detection element 311 further, and prevent deviation of the sensing information of the detection element 311 from shaking, affecting the detection result.

In another embodiment of the present invention, the detection element 311 is a combination of a force sensor, a pressure sensor, an acceleration sensor, a position detection element, and a power unit, which can realize more accurate blockage detection and improve user experience.

In order to meet the needs of different users, the form of the alarm signal can be designed as one or more combinations of luminous signal, vibration signal, and sound signal. Different forms of signal expression are convenient for users to obtain the alarm signal in time according to their needs and take corresponding measures to enhance user experience.

FIG.15a is an exploded view of the infusion mechanism module according to an embodiment of the present invention. FIG.15b is a schematic view of the lower case according to an embodiment of the present invention. FIG.15c is a schematic view of the frame according to an embodiment of the present invention.

The infusion mechanism module 410 includes an upper case 411, a lower case 412, and a frame 417 disposed between the upper case 411 and the lower case 412. The upper case 411 is provided with at least an upper case first engaging portion 4111 and an upper case second engaging portion 4112, and the lower case 412 is provided with at least a lower case first engaging portion 4121 and a lower case second engaging portion 4122. The frame 417 is provided with at least a frame first engaging portion 4171 to engage with an upper case first engaging portion 4111 and the lower case first engaging portion 4121 at the same position, improving longitudinal engaging stability of the frame 417 and the upper case 411 and the lower case 412, and reducing the complexity of the engagement. The upper case second engaging portion 4112 and the lower case second engaging portion 412 are engaged on the side of the frame 417. After the engagement, the frame 417 can be prevented from moving laterally, improving lateral engaging stability of the frame 417 and the upper case 411 and the lower case 412. Here, 'longitudinal' refers to the thickness direction of the infusion device, and 'lateral' refers to the length direction of the infusion device, as shown in FIG.3a. Each engaging portion includes one or more hooks, blocks, holes, and grooves that can be engaged with each other. The position can be flexibly designed according to the shape or arrangement of the upper case 411, the lower case 412 and the frame 417, and there is no specific limitation here, as long as the longitudinal and lateral engagement stability of the upper case 411, the lower case 412 and the frame 417 can be achieved.

The lower case 412 is provided with a circuit board for supplying power to specific units, and the circuit board is a rigid circuit board or a flexible circuit board. Preferably, in the embodiment of the present invention, the circuit board is flexible. The shape of the flexible circuit board is adjustable and can be flexibly designed according to the internal space of the infusion mechanism module 410. At the same time, multiple connection ends can be provided on the flexible circuit board to be electrically connected to each electrical connection terminal on the frame 417 to optimize the circuit layout, thereby realizing the circuit conduction inside the infusion mechanism module 410 and improving the electrical connection stability of all parts.

The frame 417 is used to carry the internal parts of the infusion mechanism module 410. Here, the side of the frame 417 facing the upper case 411 is the upper side, and the side facing the lower case 412 is the lower side. Take the open end of the reservoir as the baseline, one side for accommodating the reservoir is the right side, and the other side is the left side. What needs to be explained here is that "upper side", "lower side", "left side", and "right side" are relative position concepts, and the positional relationship is shown in FIG.15a. The right side of the frame 417 is

provided with a reservoir accommodating cavity for accommodating the reservoir, the shape is adapted to the reservoir, and the lower side of the frame 417 is provided with a plurality of lugs 4173 for carrying the reservoir. The right side of the frame 417 is also provided with a plurality of second frame engaging portions 4172, and a plurality of reservoir engaging portions (not shown) are provided on the outer side of the reservoir to engage with the frame second engaging portion 4172, so that the reservoir and the frame 417 can connect stably.

A driving wheel assembly and a power supply are arranged on the left side of the upper side of the frame 417, and the power supply is a double-row battery, which is arranged on both sides of the driving wheel assembly, respectively. The electrical connection elements in the infusion mechanism module 410 are all arranged on the left side of the lower side of the frame 417, and the power supply supplies power to the components, which is connected to the circuit board through the approximately "L"-shaped elastic conductor to realize the circuit conduction inside the infusion mechanism module 410. As shown in FIG.4a and FIG.4c, the frame 417 is provided with a plurality of positioning posts 138 of the elastic conductor 136, the position is adapted to the position of the power supply, and is used to fix the elastic conductor 136; the frame 417 is also provided with holes 4174 (as shown in FIG.15a), the elastic conductor 136 realizes the electrical connection between the power supply and the circuit board, which are provided on the upper and lower sides of frame 137, respectively, through the holes 4174, thereby realizing power supply to all electrical components. A rotating shaft 1315 is also provided on the frame 417, for sleeving the driving unit 1310 and providing a fulcrum for the rotation of the driving unit 1310, and is arranged between the driving wheels 134. A conductive retaining wall 1318 is also provided on the end of the driving unit 1310, for limiting the driving end of the driving unit 1310. A conductive tower-spring 1315 is also provided on the drive unit 1310, which is used to connect the drive unit 1310 and the circuit board. The conductive tower-spring 1315 has a large diameter in the middle part and a small diameter in the end parts, which can fix the drive unit 1310 and improve the electrical connection stability with the circuit board. A plurality of positioning tables 1319 of power unit 1311 are also arranged between the conductive platform 1314 and the elastic conductor 1316, so that the power unit 1311 can only be arranged along the linear position defined between the positioning platforms 1319, and prevent the power unit 1311 from being touched with other conductive elements, which will cause a short circuit and fail the infusion device. A conductive platform positioning post 1317 and a stop 1316 is also provided at the end of the frame to fix the conductive platform 134, as shown in FIG. 7. The specific features of each component are as described above and will not be repeated here. Through the above arrangement of the frame 417, the components of the infusion mechanism module 410 can be integrated into the frame 417, making full use of the internal space of the infusion mechanism module 410, improving the integration of the internal arrangement, and effectively reducing the volume of the infusion mechanism module 410. At the same time, the physical connection stability and electrical connection stability of each component can be ensured, and the electrical connection reliability of the internal arrangement of the infusion mechanism 410 can be improved.

In the embodiment of the present invention, the frame 417 may be a molded member including upper side, lower side, left side and right side or integrated by splicing all or some components.

For example, part of the components are a molded member and then integrated by splicing with other components, or integrated by splicing each component. Each component itself can also bea molded member or integrated by splicing according to actual needs, and there is no specific limitation here. When the frame is a molded member, the process is simple, the volume is small, the connection is firm, the material is saved, and the cost is reduced. When the frame is integrated by splicing, it can be flexibly selected according to the requirements of the components that the frame needs to carry to optimize the internal design of the infusion mechanism module.

FIG.16a is a schematic view of the infusion device according to an embodiment of the present invention. FIG.16b is a schematic view of the needle mechanism according to an embodiment of the present invention. FIG.16c is a schematic view of the drug storage unit and the cavity according to the embodiment of the present invention. FIG.16d is a schematic view of the security base according to an embodiment of the present invention.

As shown FIG.16a, the infusion device of the embodiment of the present invention includes control mechanism module (not shown), infusion mechanism module 510, adhensive patch 520 and security base 522, the infusion mechanism module includes the above mentioned mechanical unit, control unit, such as, reservoir, driving wheel etc., and further includes the infusion needle unit 521, which is provided on the upper case 511a, and the adhensive patch 522 is provided on the bottom of the lower case 511b, the security base is provided on the bottom of the adhensive patch 520. The infusion needle includes an infusion needle holder 5211 and an infusion needle 5212, the infusion needle base 5211 is used to fixedly place the infusion needle 5212, making the drug flow infused under the skin of the patient.

As shown in FIG.16b, the infusion needle 5212 is fixedly placed on the needle holder 5211. The infusion needle 5212 is a U-shaped steel needle. The infusion needle 5212 includes a front end 5212a and a rear end 5212b, both of which extend out of the needle holder 5211. The front end 5212a is used to communicate with the opening 20 of the reservior 5131, while the rear end 5212b is used to inserted under the skin of the patient.

As shown in FIG.16c, the upper case 511a is further provided with a cavity 30 including a first outlet 31 and a second outlet 32. The first outlet 31 is in sealed communication with the opening 20. Here, the sealed communication means that the cavity 30 and the reservior 5131 are in communication with each other through the opening 20 and the first outlet 31 without drug leaking. The second outlet 32 is sealed by an elastic seal 40. When the front end 5212a pierces the elastic seal 40, the infusion needle 5212, the cavity 30, the opening 20 and the reservior 5131 are in communication. Therefore, the drug can enter the infusion needle 5212 from the reservior 5131 to the rear end 5212b or be infused under the skin of the patient.

Please continue to refer to FIG.16a, FIG.16b and FIG.16c, in the embodiment of the present invention, the needle holder 5211 has three positions: an initial position, an intermediate position, and a working position. Among them, the intermediate position is set between the initial position and the working position. Since the infusion needle 5212 is fixed on the needle holder 5211, in the embodiment of the present invention, the needle unit also has the above three positions.

Preferably, in the embodiment of the present invention, when the needle holder 5211 is at initial position, the front end 5212a does not pierce the elastic seal 40, so it is not communicated with the second outlet 32. When the needle holder 5211 reaches the intermediate position or the working position, the front end 5212a pierces the elastic seal 40 communicating with the second outlet 32. At this time, the drug, along the cavity 30 and the infusion needle 5212, flows from the reservior 5131 to the rear end 5212b.

At the beginning, the needle holder 5211 is at the initial position with the infusion needle 5212 non-communication with the reservior 5131. Therefore, the cavity of the infusion needle 5212 is full filled with air. When leaving the factory, the non-communication between the infusion needle 5212 and the reservior 5131 can improve the flexibility of the setting position of the needle unit, which optimizes the architecture design of the infusion device.

After the needle holder 5211 reaches the intermediate position, the front end 5212a pierces the elastic seal 40 in order to make the infusion needle 5212 communicate with the reservior 5131 to balance the internal and external pressures. At this time, when the infusion unit is activated, the drug can flow, along the infusion needle 5212, to the rear end 5212b, to prime the fluid path and exhaust the air in the cavity of the infusion needle 5212. When the needle holder 5211 reaches the middle position, the rear end 5212b will protrude from the adhesive patch 520. When priming the fluid patch, in order to completely expel the air in the infusion needle 5212, a small amount of drug from will be flowed out from the needle rear end 5212b. As shown in Fig. 16d, an infusion needle accommodating part 5220 is provided on the security base 522, the position is corresponded to the rear end 5212b, for accommodating the rear end 5212b protruding from the adhesive patch 520, preventing the rear end 5212b from stabing the user, and at the same time, accommodating the drug flowed out from the rear end 5212b when priming, preventing the drug being contaminated due to the drug flowed out and exposed in the air, before the back end 5212b pierced under the skin. If contaminated drugs are infused into the body, it may cause safety risks.

As mentioned above, the adhesive patch includes a protective film, tape and release paper. The tape and the release paper are respectively provided with a first through hole and a second through hole for the infusion needle to pass through. In the embodiment of the present invention, the diameter of the first through hole and the second through hole is smaller than the diameter of top opening of the infusion needle accommodating part 5220, preventing the drug contained in the infusion needle accommodating part 5220 from overflowing from the opening of the infusion needle accommodating part 5220 and infiltrating into the tape, due to shaking or other reasons, which will cause the poor adhesiveness of the tape, and the infusion device will be easily detached from the skin, affecting the user experience.

When the priming is over, the release paper of the adhesive patch 520 is torn off, the security base 522 is removed at the same time, the infusion device is pasted on the user's skin, and then the needle holder 5211 reaches the working position, the rear end 5212b pierces the skin to infusion the drug into the body.

The security base 522 is also provided with a third through hole 5222, which is used to fill the reservoir 5131 with drug, and the position is corresponded to the drug inlet 50, as shown in FIG.

16c. Preferably, the third through hole 5222 is tapered to facilitate guiding an external drug filling device, such as a syringe, to be inserted vertically into the reservoir 5131. The part with smallest diameter of the syringe is compatible (except the needle of the syringe) to the bottom opening (the opening with bigger diameter) of the tapered third through hole, and is used to limit the syringe and prevent the syringe from being inserted too deep or too shallow, which affects the effect of drug infusion. Correspondingly, the tape and release paper of the adhesive patch 520 are provided with a corresponding fourth through hole (not shown), so that the needle of the syringe could pass through the third through hole 5222 and the fourth through hole to fill drug.

As shown in FIG.16a, the thickness of the security base 522 is gradually decreasing from the end close to one end of adhesive patch 520 to the middle part of adhesive patch 520, that is, gradually decreasing from the F end to the E end, and forms a plane with the other end, R end, of the adhesive patch 520, so that the infusion device can be stably placed on the desktop or other places during priming. Compared with the security base with an area similar to that of the lower case 511b, the trapezoidal security base 522 with a variable thickness can reduce the weight and volume of the entire infusion device, which is conducive to the miniaturization of the infusion device; Compared with the security base with uniform thickness with an area similar to that of the rear end 5212b. Since the two ends of the infusion device have the same height difference relative to the security base, it cannot be placed on the table stably, and it may be shaked by accidentally touched, which causes the drug in the reservoir 5131 or the infusion needle accommodating portion 5220 to shake and affects the use effect. The security base 522 with a variable thickness can form a plane with the lower case 511b of the infusion device. So it can be stably placed on the desktop.

Continuing to refer to FIG.16d, the security base 522 is trapezoidal, that is, the bonding surface with the adhesive patch 520 is trapezoidal, the short side of the trapezoid is the thicker end F, and the long side of the trapezoid is the thinner end E. The F end corresponds to the unlocking hole of the infusion device (as shown in FIG.3a 119), the length of the F end is less than the length of the unlocking hole, and the length of the E end is smaller than the width of the infusion device. Preferably, the security base 522 is in the shape of an equilateral trapezoid, which makes the infusion device as small as possible while making the infusion device more stable on the desktop during priming.

As a summary, the present invention discloses a drug infusion device with security base, the security base is provided with an infusion needle accommodating part, which can accommodate the infusion needle protruding from the bottom of the infusion device when the infusion device is priming, preventing the infusion needle from stabbing the user, and at the same time, it can accommodate the drug flowed out from the infusion needle, preventing the drug from being contaminated and causing safety hazards.

While the invention has been described in detail regarding the specific embodiments of the present invention, it should be understood that it will be appreciated by those skilled in the art that the above embodiments may be modified without departing from the scope and spirit of the invention. The appended claims define the scope of the invention.

CLAIMS

1. A drug infusion device with security base, comprising:

   a reservoir, used for accommodating the drug to be infused, provided with a piston and a screw;

   a driving wheel, connected with the screw, driving the screw to push the pistion forward by rotation;

   an infusion needle unit, including an infusion needle and a infusion needle holder, wherein the infusion needle holder is used to fixedly place the infusion needle, when the infusion needle unit is at the non-initial position, the infusion needle communicated with the reservoir;

   an adhesive patch, for attaching the infusion device module to the skin surface; and

   security base, arranged on the bottom of the adhesive patch, provided with an infusion needle accommodating part, for accommodating the infusion needle when the infusion device is priming.

2. The drug infusion device with security base of claim 1, wherein

   the thickness of the security base is gradually decreased from the end close to an end of the adhesive patch to the middle part of the adhensive patch, and forms a plane with the other end of the adhesive patch.

3. The drug infusion device with security base of claim 2, wherein

   the bonding surface of the security base and the adhesive patch is equilateral trapezoidal.

4. The drug infusion device with security base of claim 1 wherein

   the adhesive patch includes at least one layer of tape and a protective film, the protective film is fixed around the outer contour of the at least one layer of tape.

5. The drug infusion device with security base of claim 1, wherein

   the adhesive patch includes at least two layers of tape.

6. The drug infusion device with security base of claim 5, wherein

   the adhesive patch further includes at least one layer of protective film.

7. The drug infusion device with security base of claim 4 or claim 6, wherein

   the rockwell hardness of the protective film is greater than that of the tape.

8. The drug infusion device with security base of claim 4 or claim 6, wherein

   the adhesive patch includes a plurality of tapes and a plurality of protective films, and every two tapes are separated by a protective film.

9. The drug infusion device with security base of claim 5 or claim 6, wherein

   the outer tape completely covers the inner tape.

10. The drug infusion device with security base of claim 5 or claim 6, wherein

the outer tape at least partially covers the inner tape.

11. The drug infusion device with security base of claim 4 or claim 6, wherein

the protective film is provided with at least one tearing portion.

12. The drug infusion device with security base of claim 8, wherein

at least one tearing portion is provided on the inner protective film.

13. The drug infusion device with security base of claim 1, wherein

the adhesive patch further includes a release paper. The tape and the release paper are respectively provided with a first through hole and a second through hole for the infusion needle to pass through. The diameter of the first through hole and the second through hole is smaller than the diameter of top opening of the infusion needle accommodating part.

14. The drug infusion device with security base of claim 1, wherein

the security base is provided with a third through hole.

15. The drug infusion device with security base of claim 14, wherein

the third through hole is tapered.

16. The drug infusion device with security base of claim 1, wherein

the infusion needle is a U-shaped steel needle.

17. The drug infusion device with security base of claim 1, wherein

the infusion device includes an infusion mechanism module and a control mechanism module. The drug reservior, the drive wheel, and the infusion needle unit are arranged on the infusion mechanism module.

18. The drug infusion device with security base of claim 17, wherein

the infusion mechanism module and the control mechanism module are designed separately, and the control mechanism module can be reused.

19. The drug infusion device with security base of claim 18, wherein

the infusion mechanism module and the control mechanism module are electrically connected by an electrical contact.

20. The drug infusion device with security base of claim 17, wherein

the infusion mechanism module and the control mechanism module are disposed of in one housing, discarded together after a single-use.

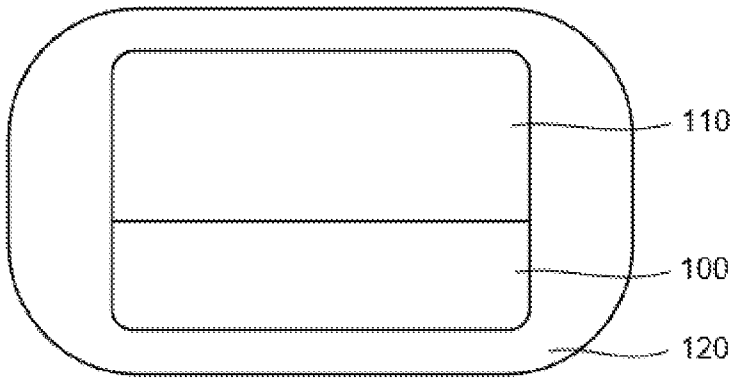


FIG.1a

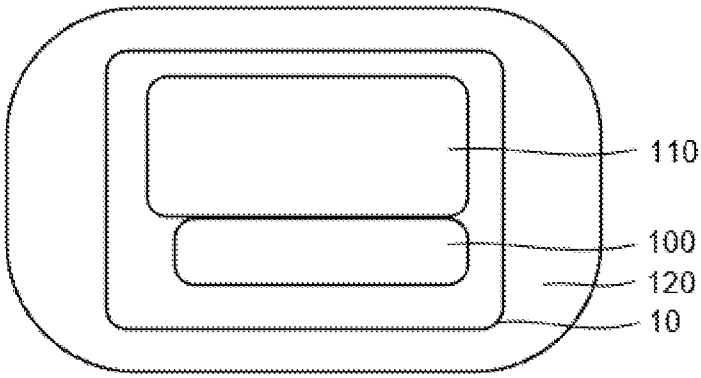


FIG.1b

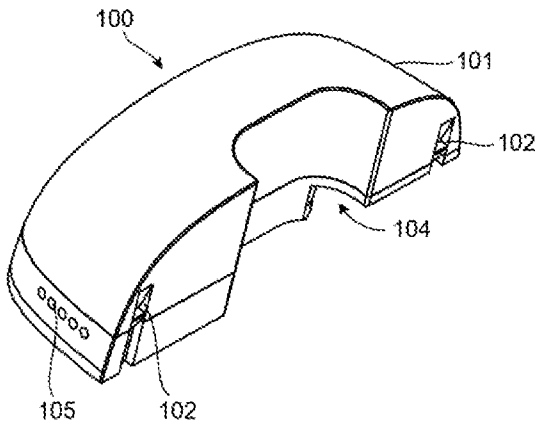


FIG.2a

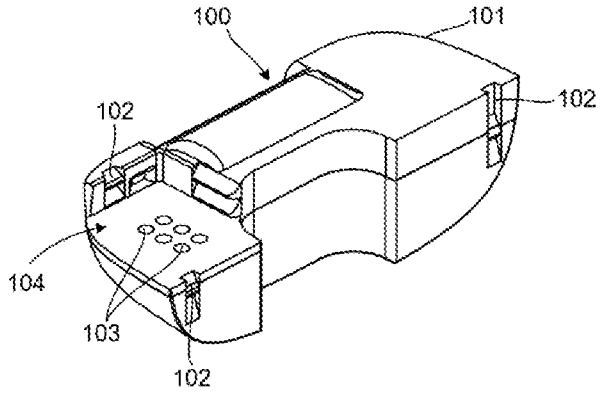


FIG.2b

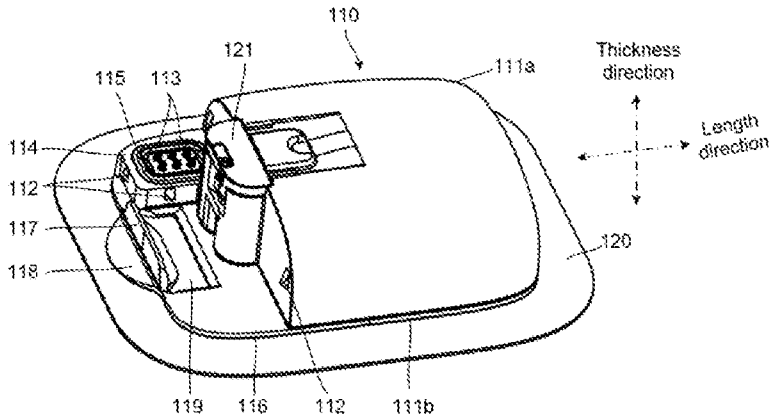


FIG.3a

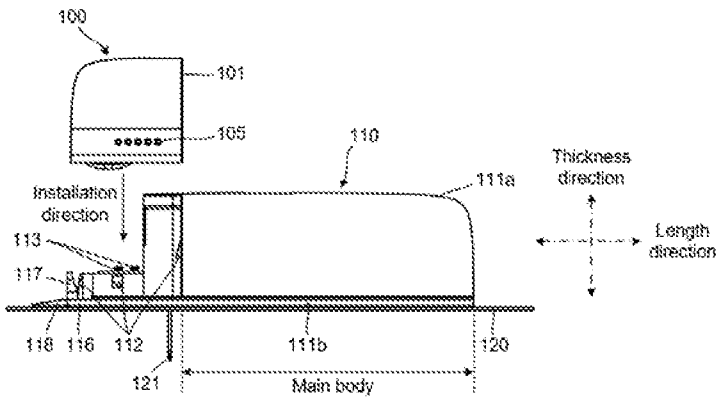


FIG.3b

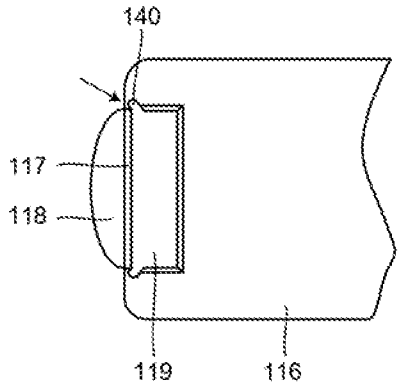


FIG.3c

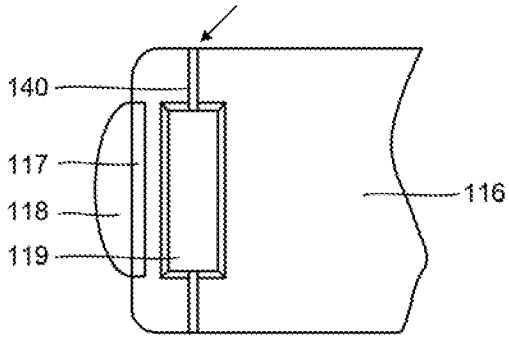


FIG.3d

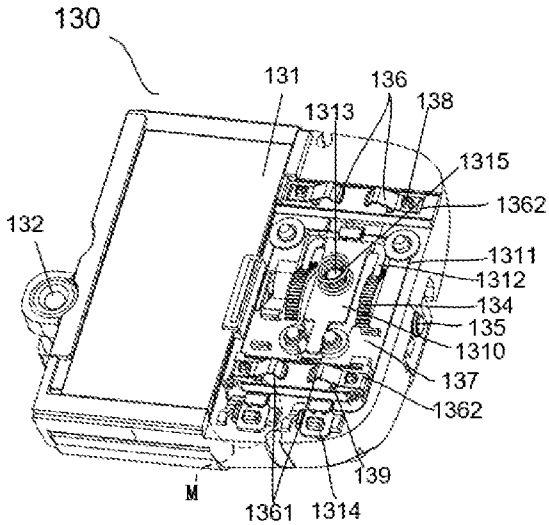


FIG.4a

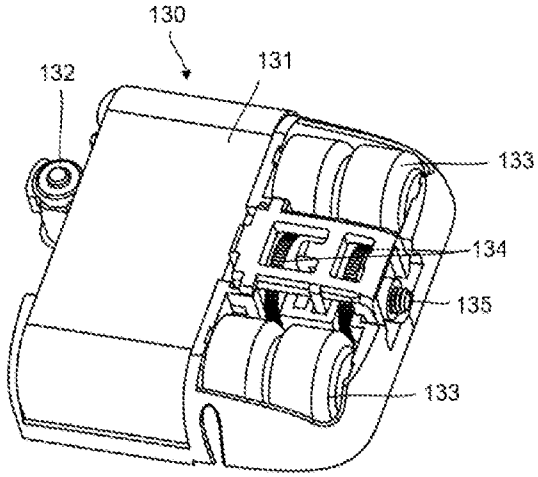


FIG.4b

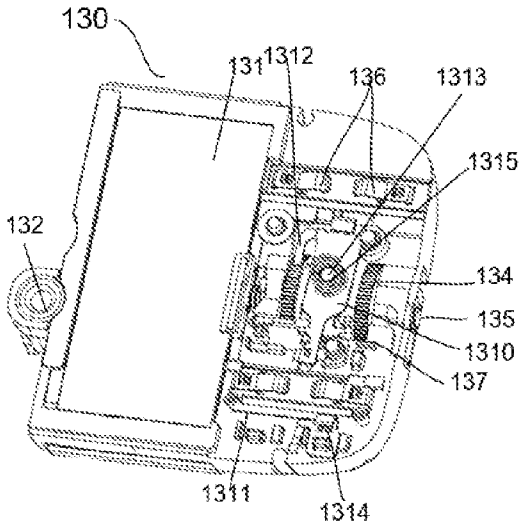


FIG.4c

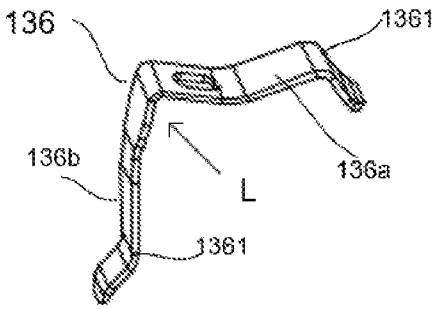


FIG.5

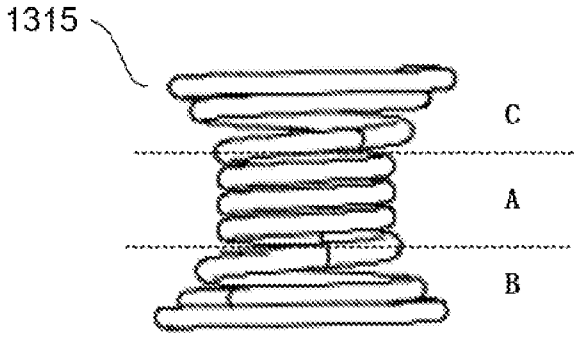


FIG.6

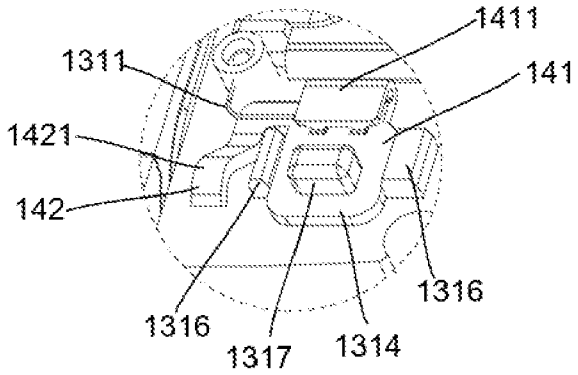


FIG.7

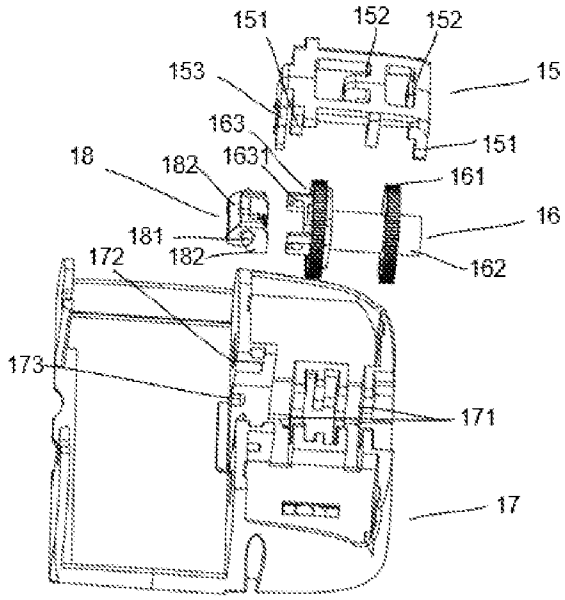


FIG.8a

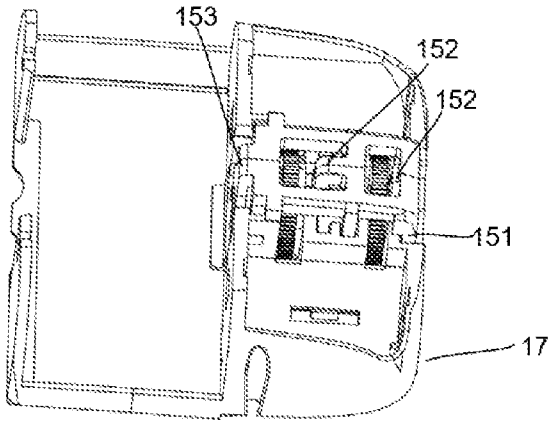


FIG.8b

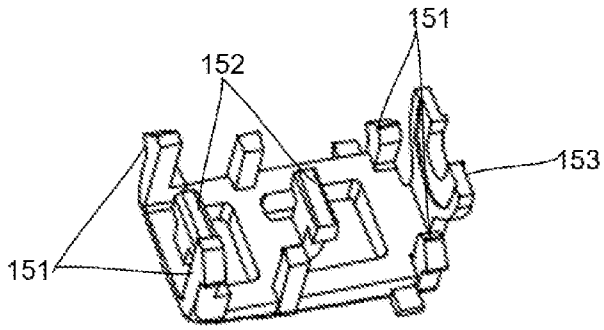


FIG.8c

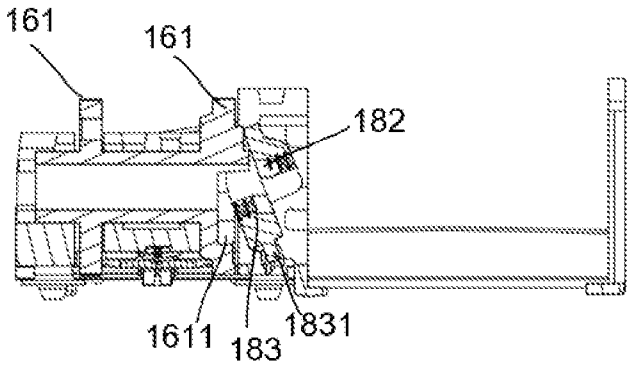


FIG.9a

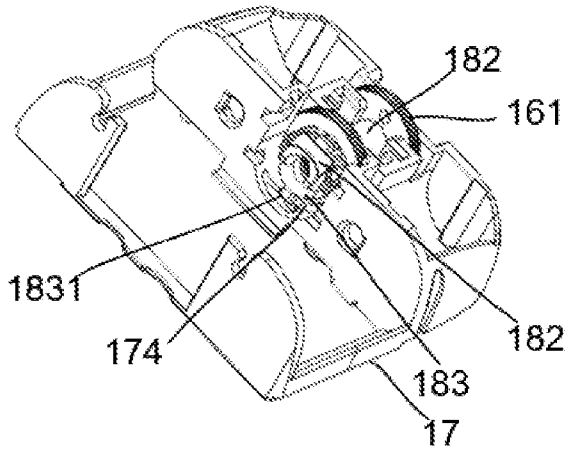


FIG.9b

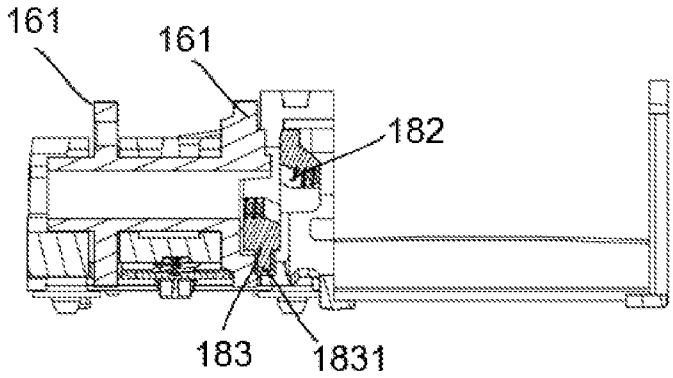


FIG.9c

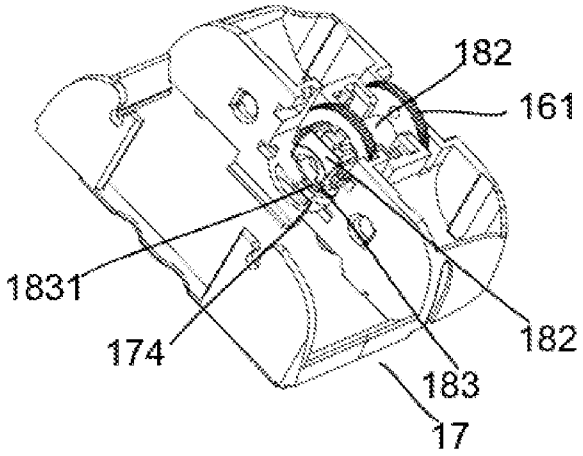


FIG.9d

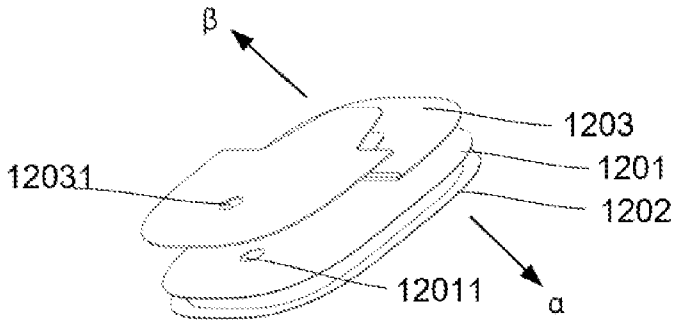


FIG.10a

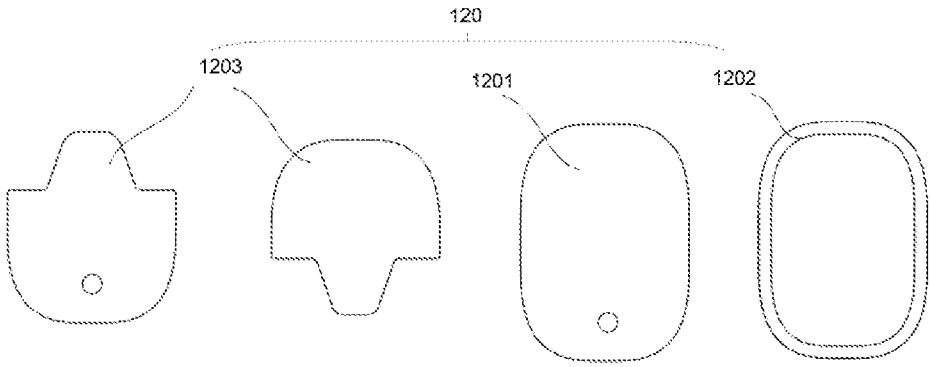


FIG.10b

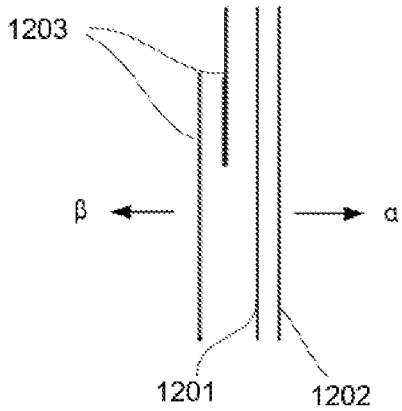


FIG.10c

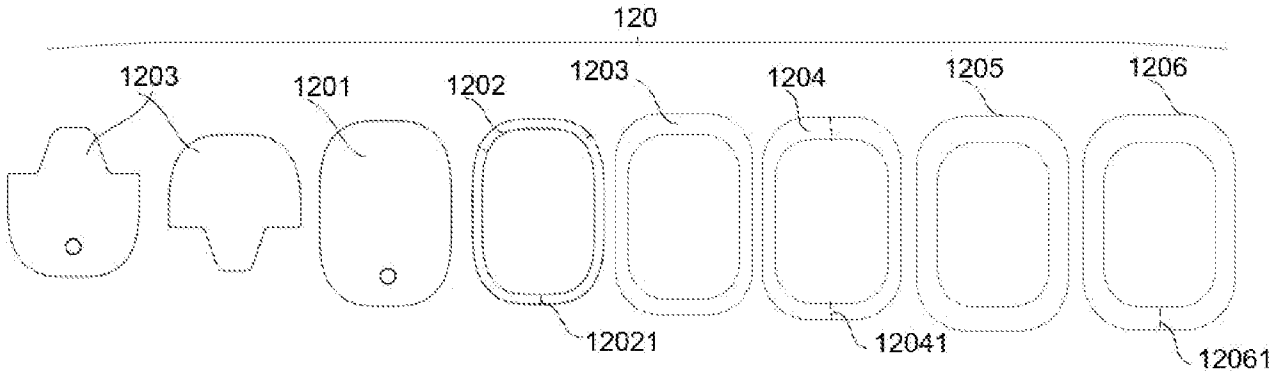


图 10d

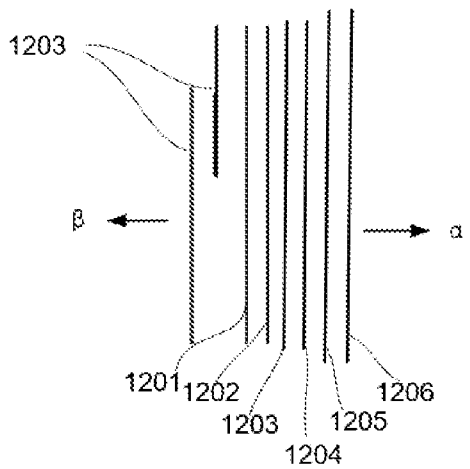


图 10e

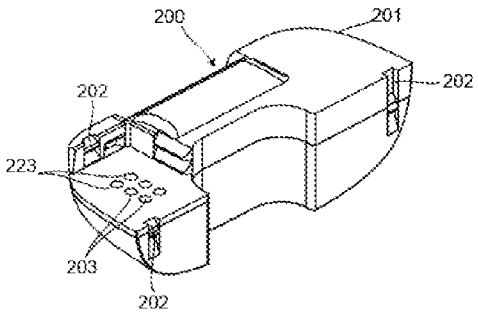


FIG.11a

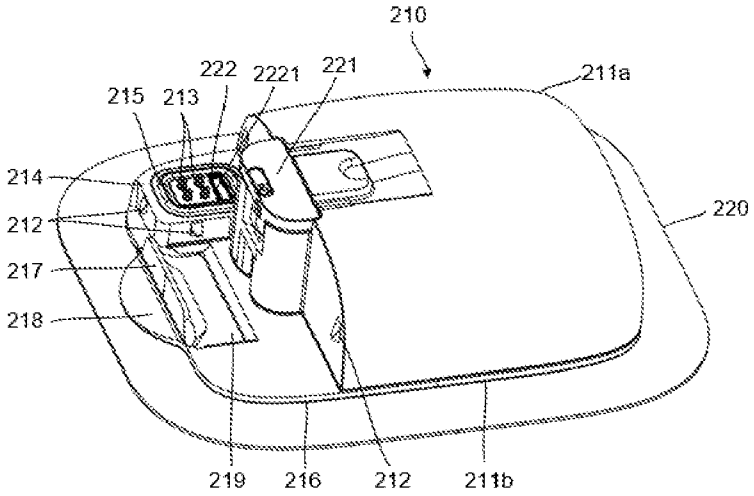


FIG.11b

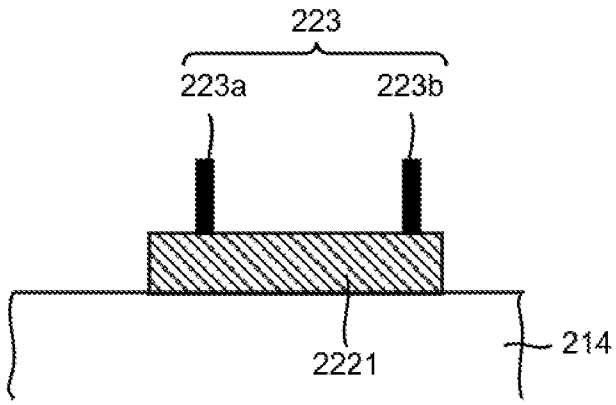


FIG.12a

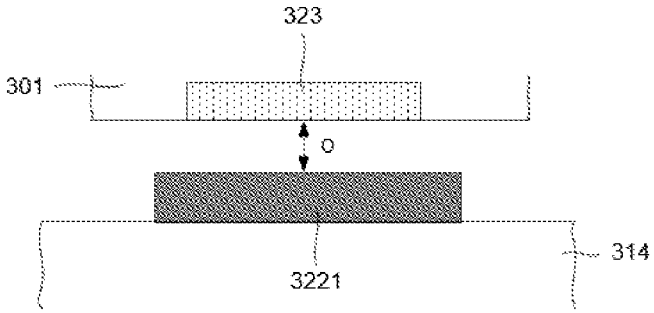


FIG.12b

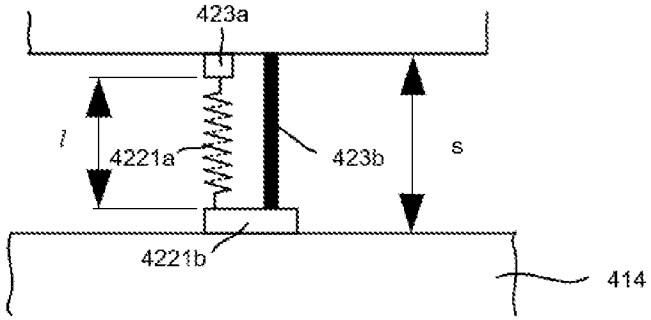


FIG.12c

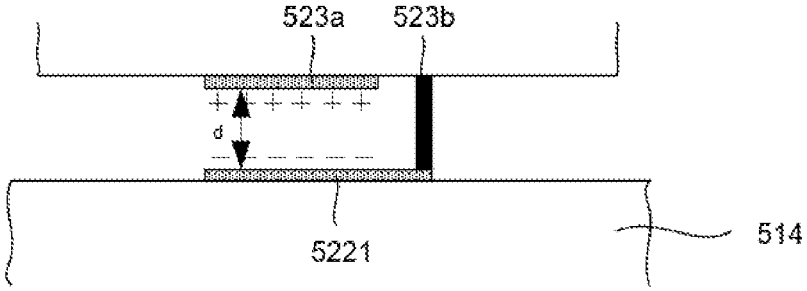


FIG.12d

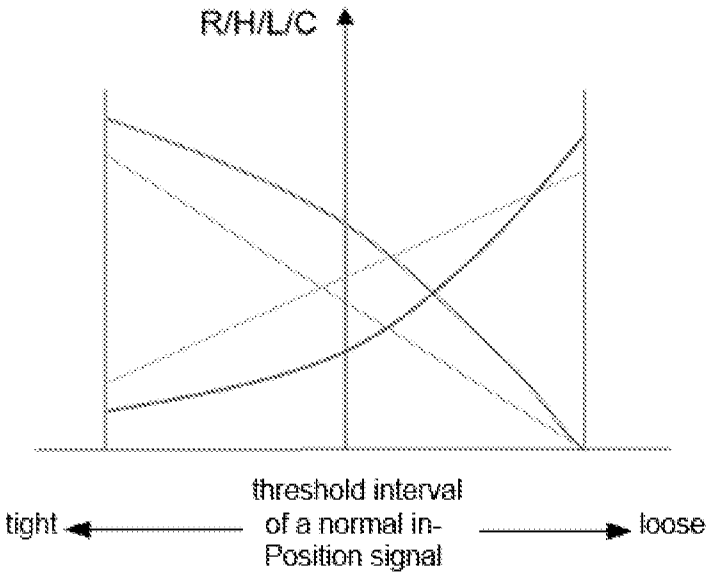


FIG.13

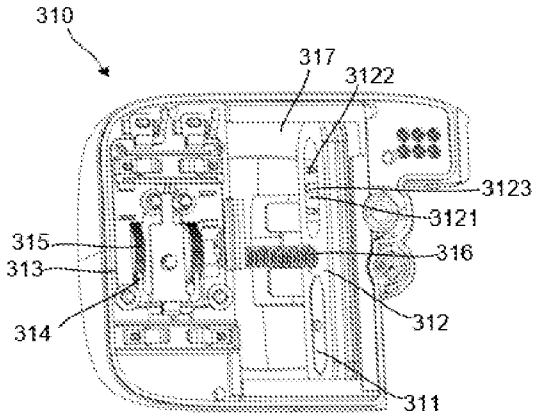


FIG.14

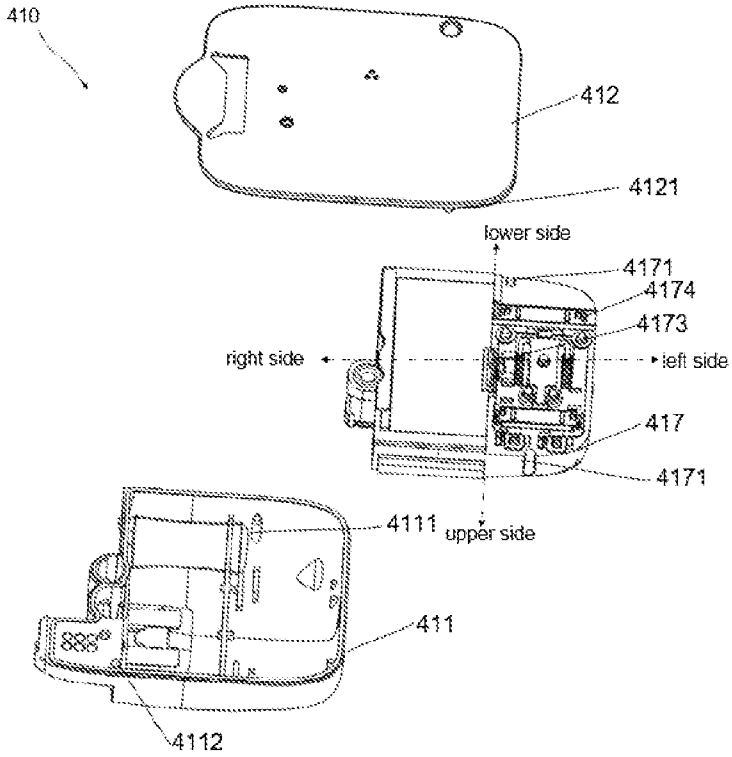


FIG.15a

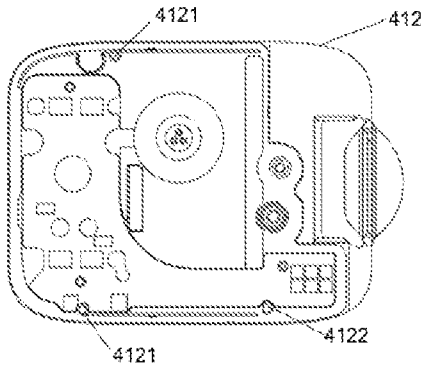


FIG.15b

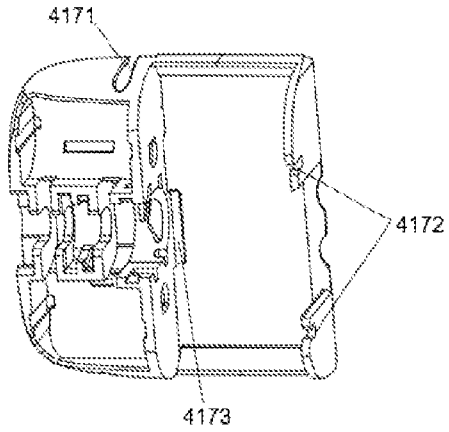


FIG.15c

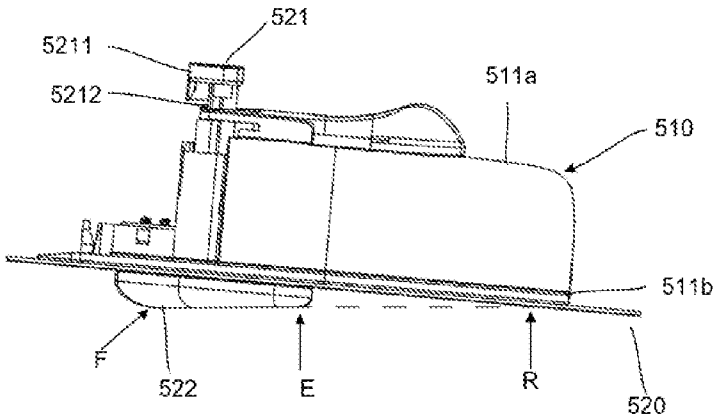


FIG.16a

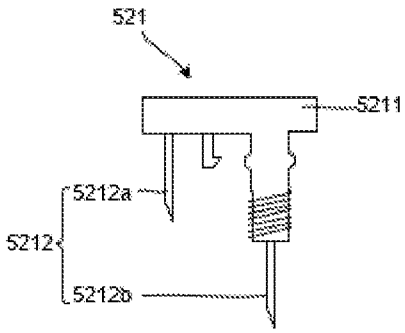


FIG.16b

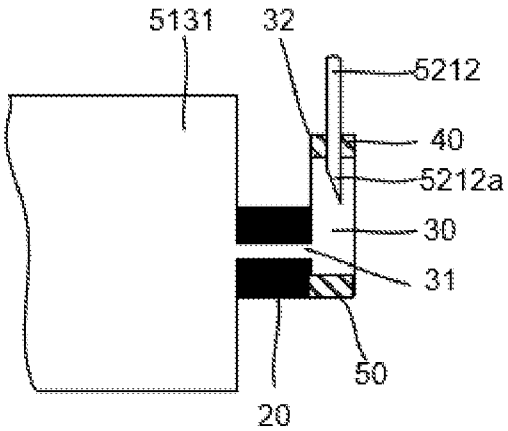


FIG.16c

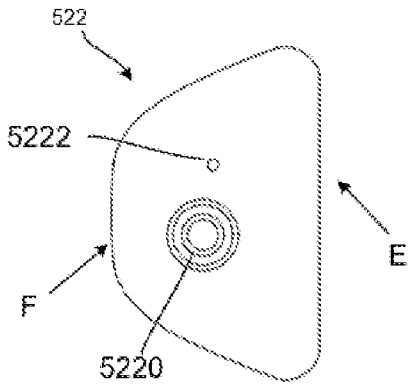


FIG.16d

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/136632

A. CLASSIFICATION OF SUBJECT MATTER

A61M 5/14(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, CNPAT, CNKI, IEEE: drug, infusion, security, needle, holder, driving, adhesive patch, accommodating, housing, priming

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2019175819 A1 (MEDTRUM TECHNOLOGIES, INC.) 13 June 2019 (2019-06-13) description paragraphs 0048-0055 and figures 6-11	1-20
A	US 10279106 B1 (TANDEM DIABETES CARE, INC.) 07 May 2019 (2019-05-07) the whole document	1-20
A	CN 209422643 U (YANG, Jing) 24 September 2019 (2019-09-24) the whole document	1-20

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 February 2022	**01 March 2022**
Name and mailing address of the ISA/CN **National Intellectual Property Administration, PRC** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing** **100088, China** Facsimile No. **(86-10)62019451**	Authorized officer **WU,Yao** Telephone No. **86-10-53961339**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/136632

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
US 2019175819 A1	13 June 2019	WO 2018027944 A1	15 February 2018
		EP 3496786 A1	19 June 2019
US 10279106 B1	07 May 2019	US 2021293810 A1	23 September 2021
		US 2019351134 A1	21 November 2019
CN 209422643 U	24 September 2019	None	