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(54) LANCET FOR BLOOD COLLECTION AND PUNCTURE NEEDLE UNIT

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(57) ABSTRACT

A lancet comprises a slider having a puncture needle holding mechanism at its one end; a cam ring which has a continuous cam groove, is rotatable about a support shaft, and has a cam ring claw and an anti-return claw for restricting the rotation; a ring spring for applying a force to rotate the cam ring; a rotatable stopper arm for holding and releasing the rotation of the cam ring; and a rotatable ratchet for restricting the direction of rotation of the cam ring. A puncture needle unit comprises a puncture needle body which is integrally molded with a protrusion to be fitted to the lancet, a rotation stop rib, and a puncture needle; and a puncture needle cap which is lightly pressed into the puncture needle body.

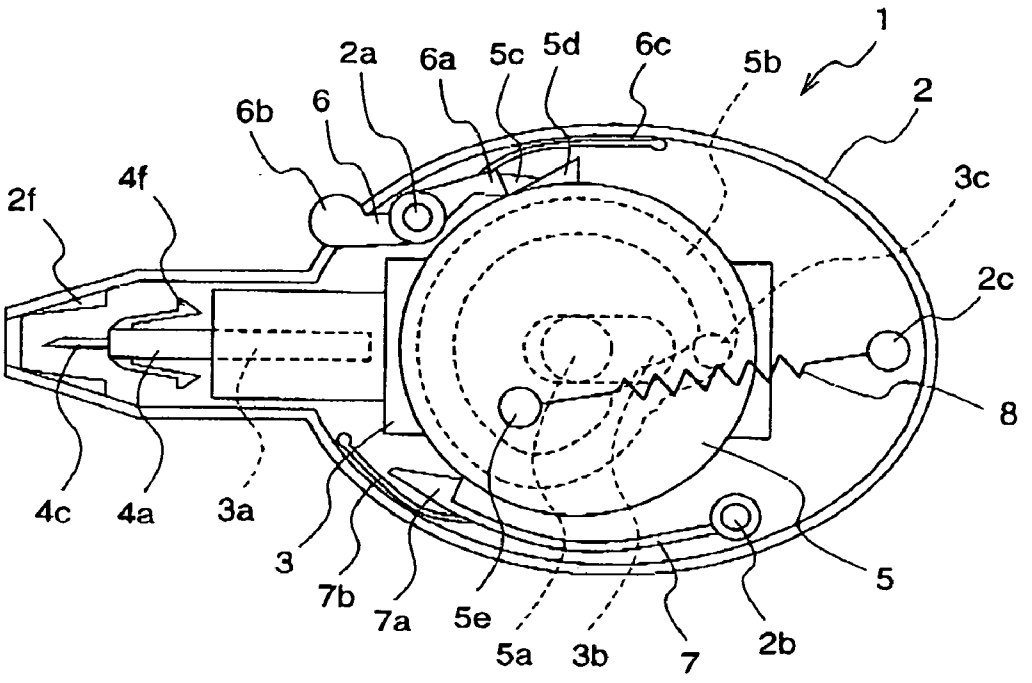


Fig.1

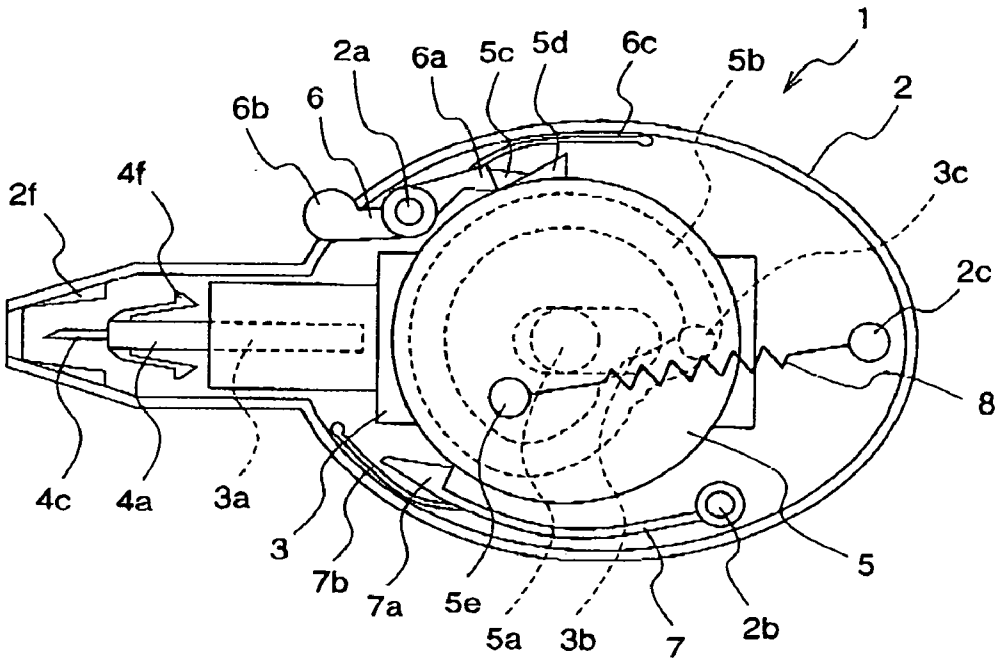

1
2a
6a
5c
5d
6c
5b
2
6b
6
4f
2f
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8
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7
2b
5

Fig.2

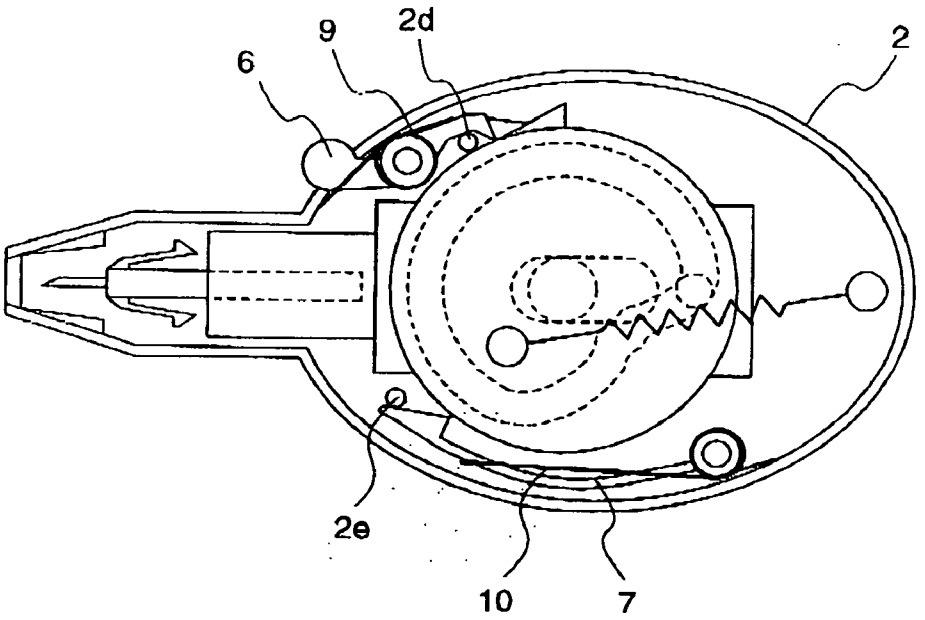

9
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2
6
2e
10
7

Fig.3(a)

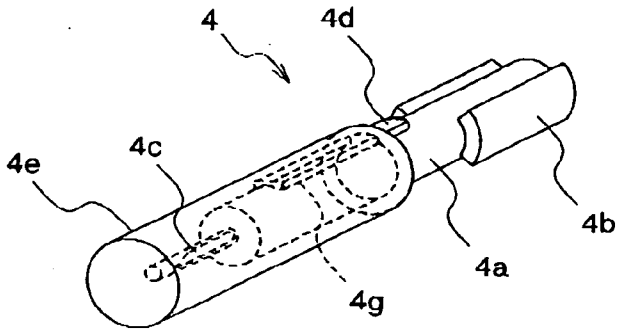
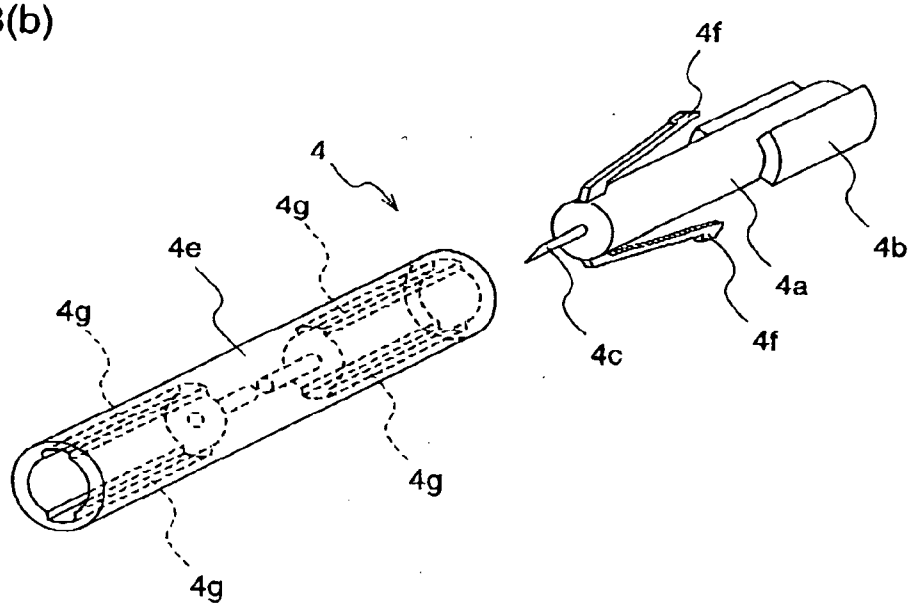


Fig.3(b)



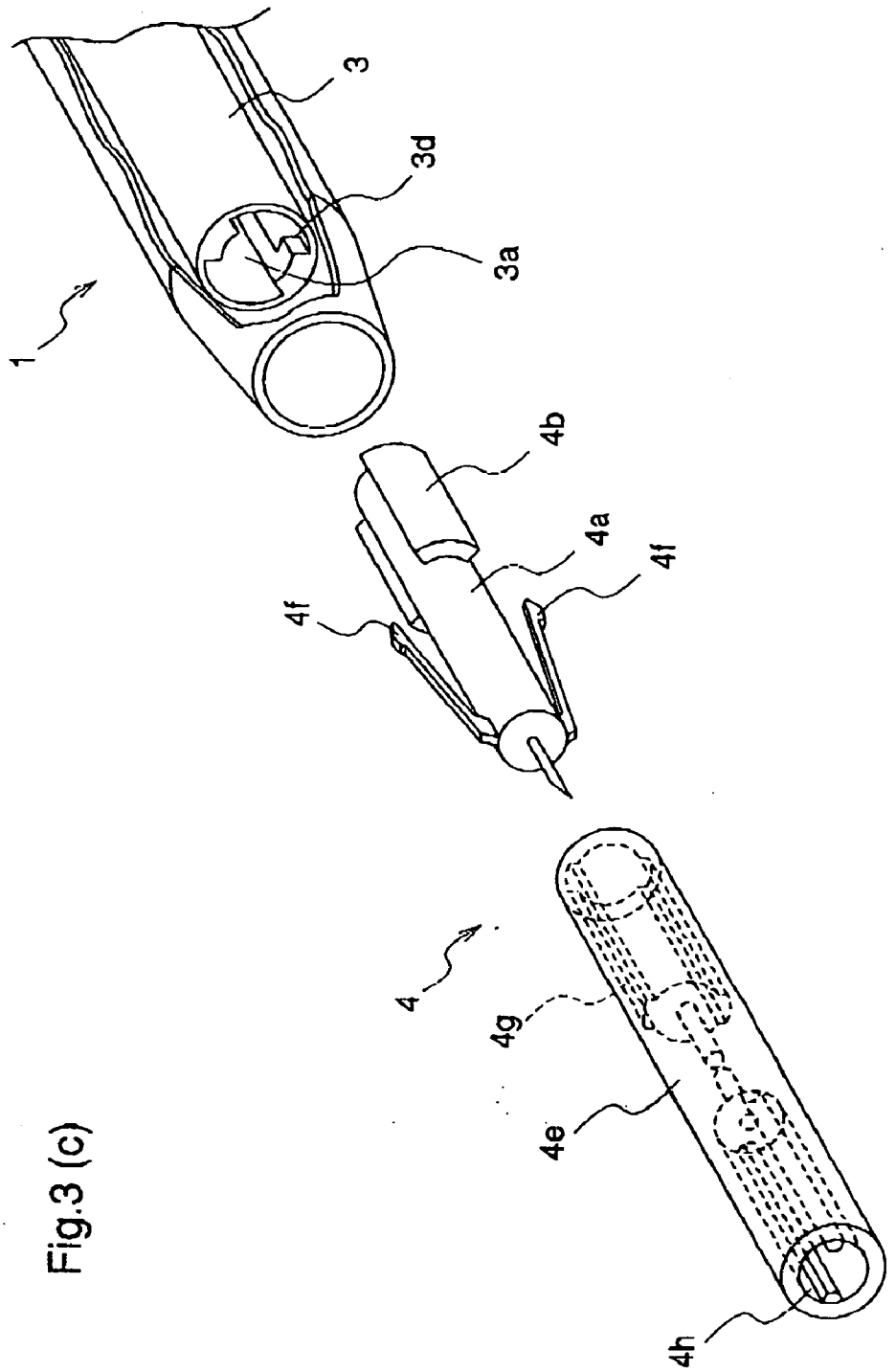


Fig.3 (c)

Fig.4(a)

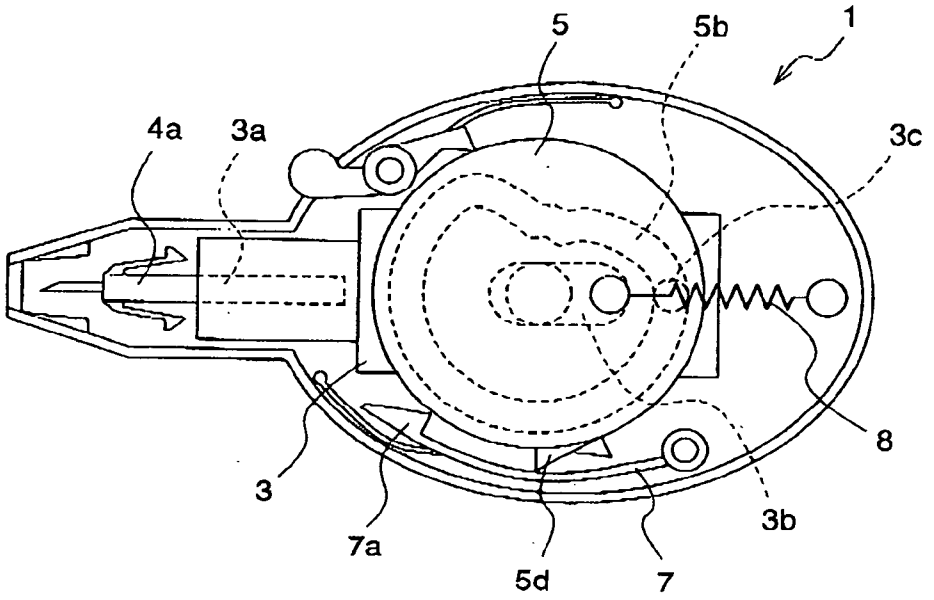


Fig.4(b)

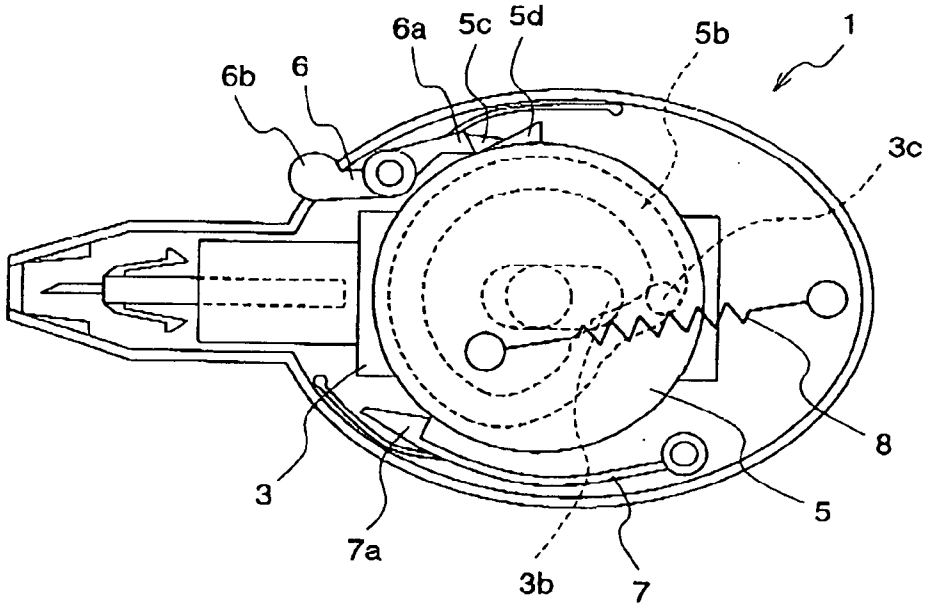


Fig.4(c)

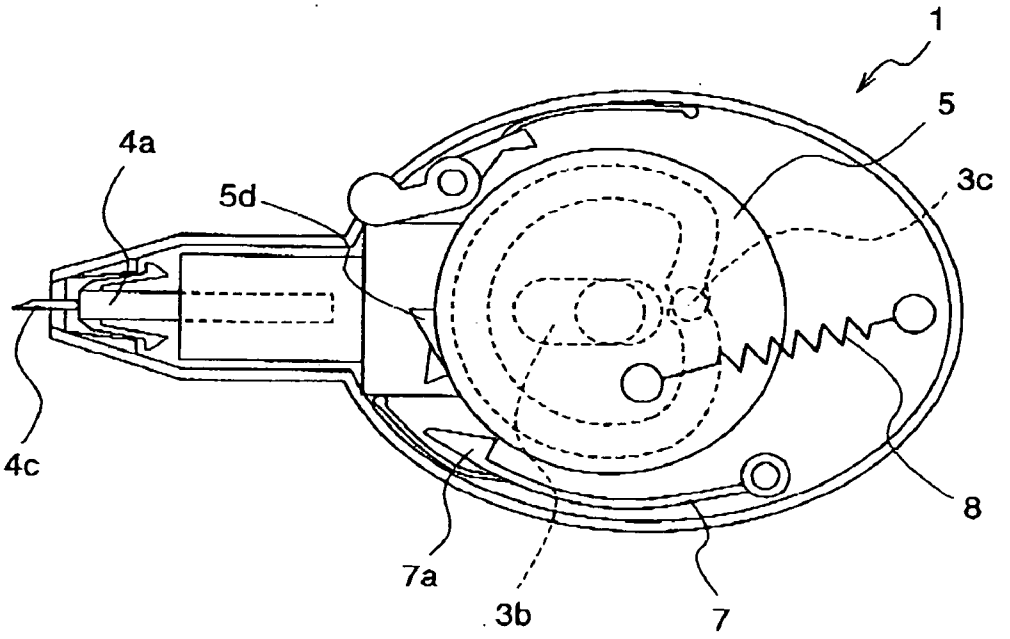


Fig.5(a)

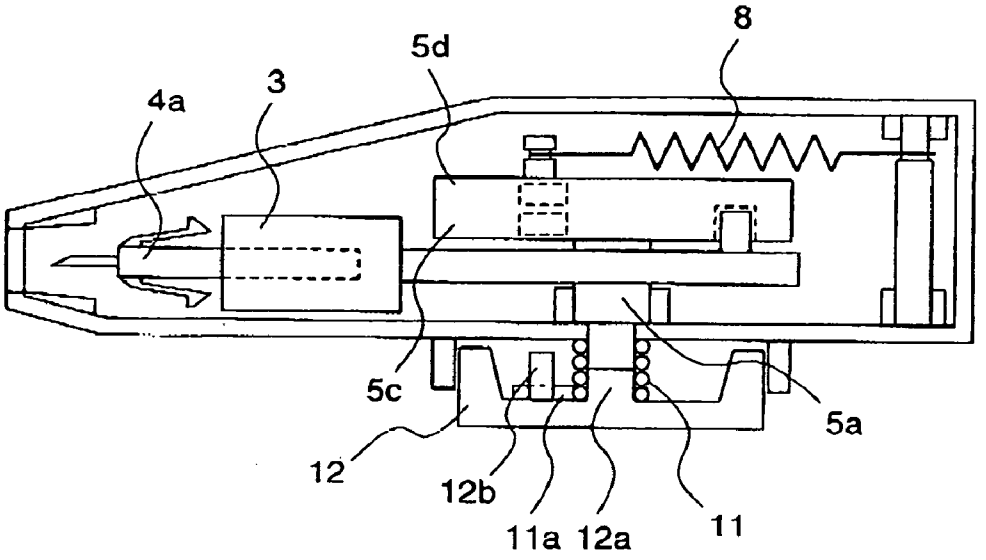


Fig.5(b)

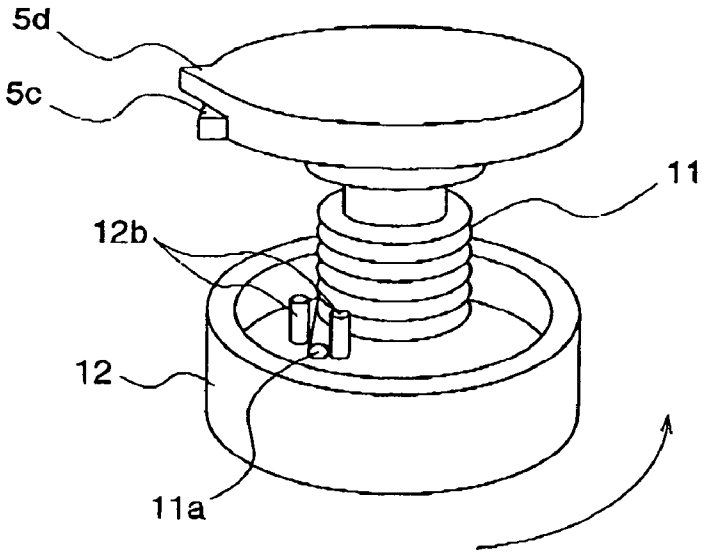


Fig.6

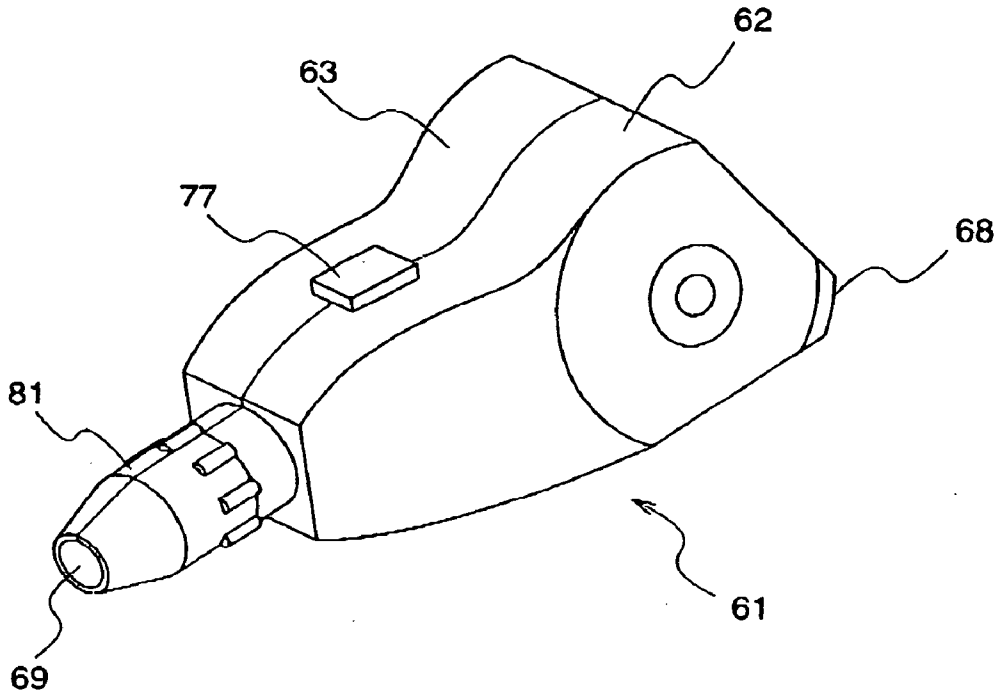


Fig.7(a)

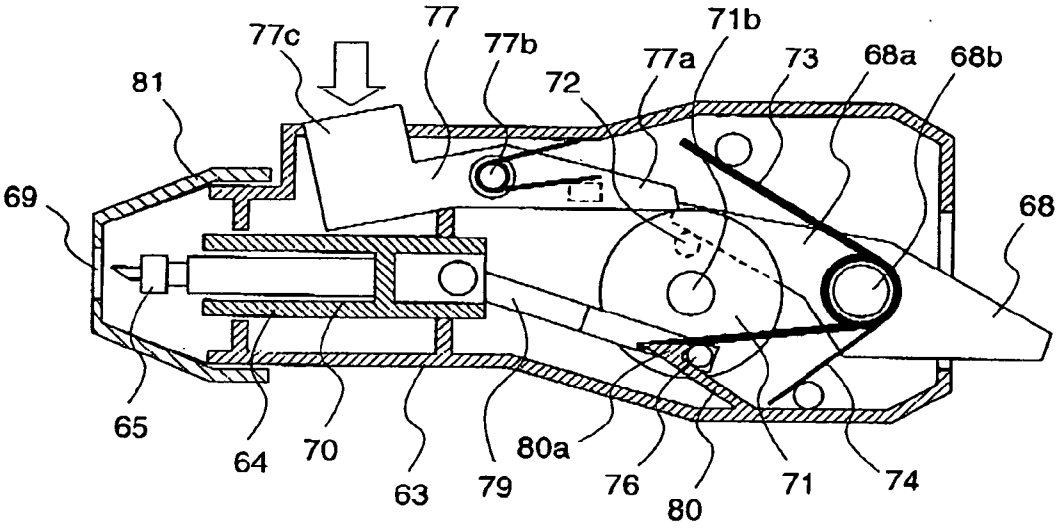

77c
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77b
71b
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80a
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Fig.7(b)

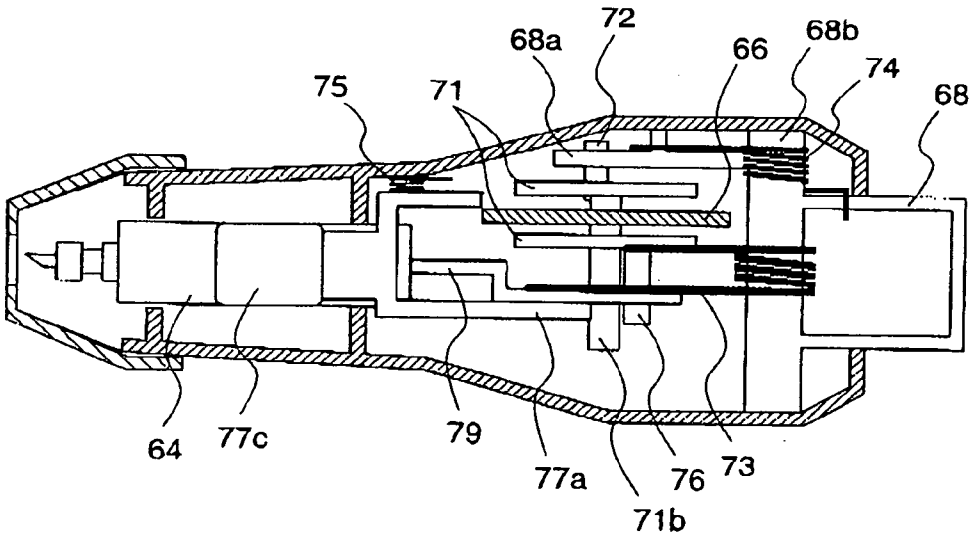

72
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66
68b
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71
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64
77c
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77a
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73
71b

Fig.8

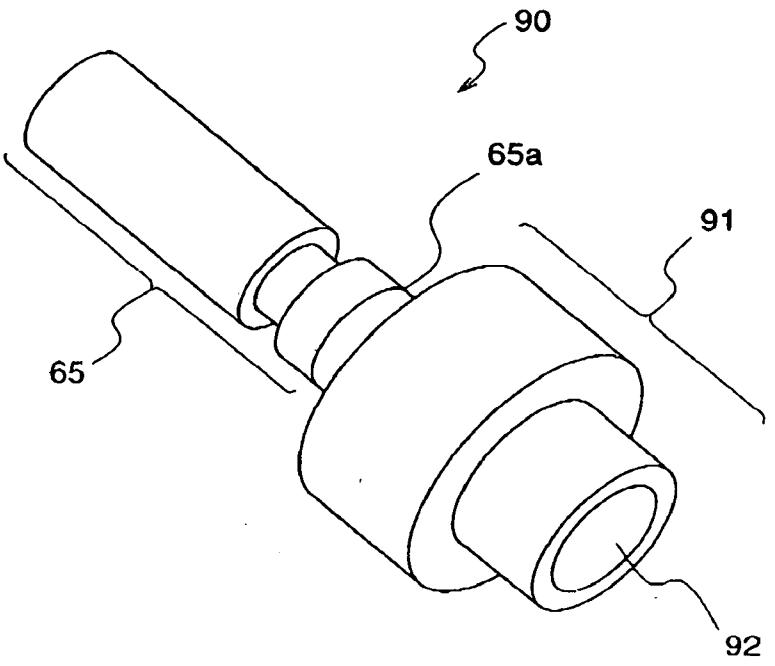


Fig.9(a)

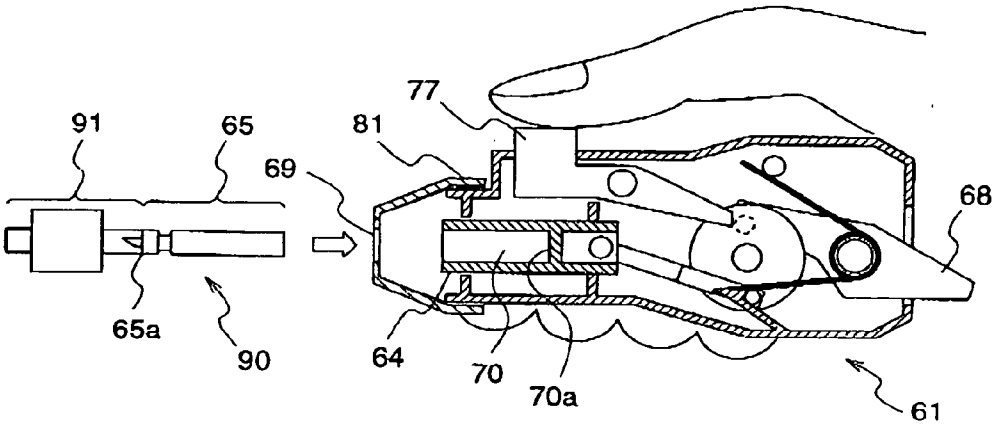


Fig.9(b)

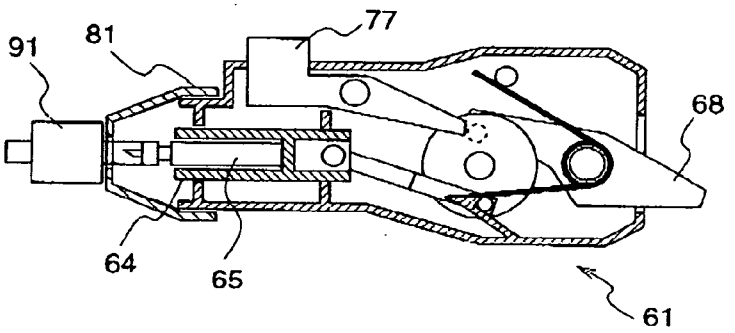


Fig.9(c)

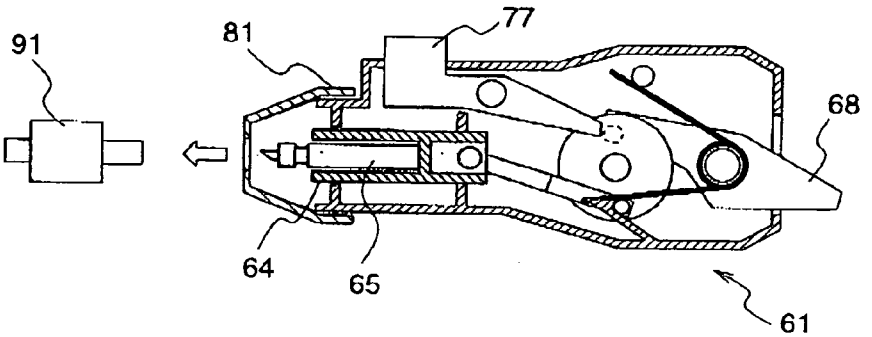


Fig.10(a)

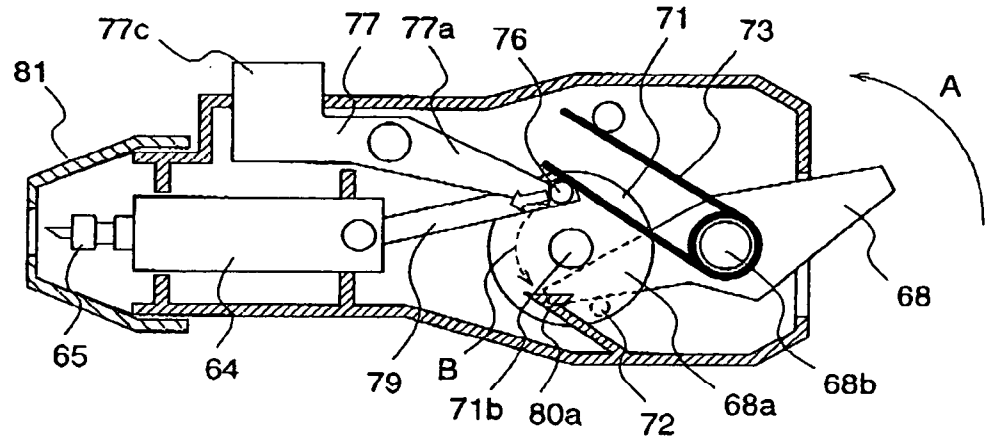


Fig.10(b)

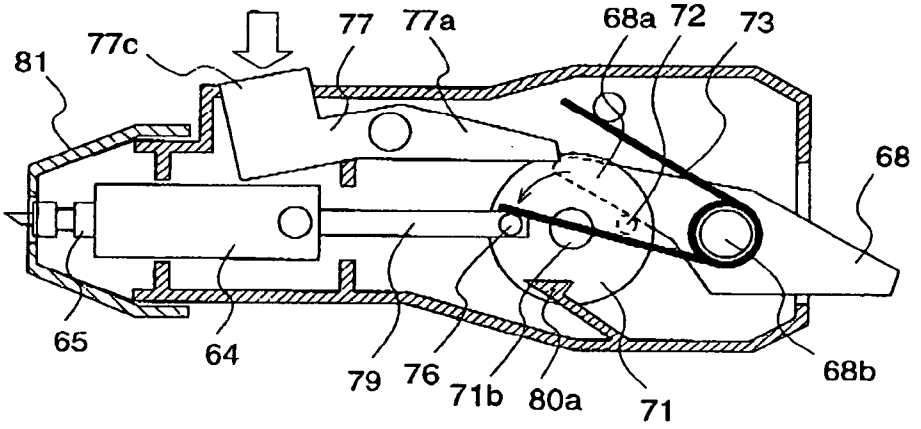


Fig.10(c)

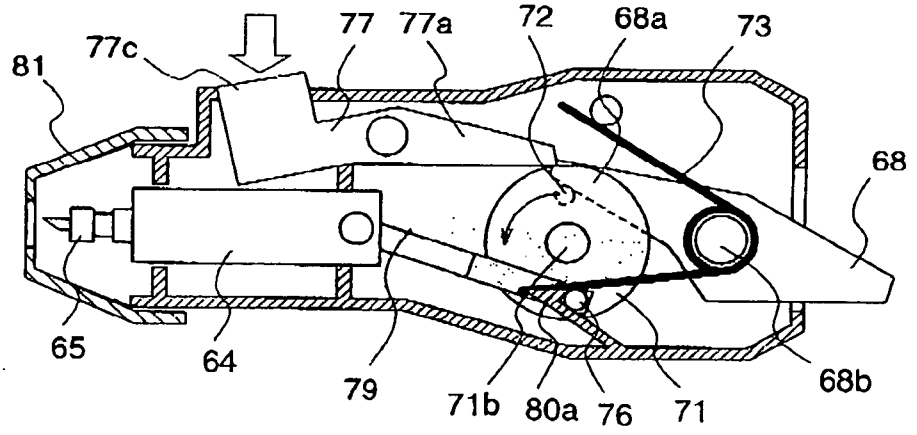


Fig.11(a)

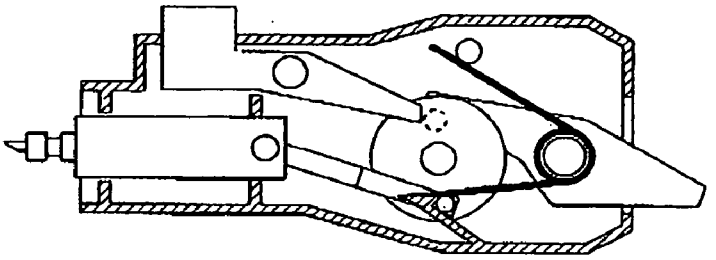


Fig.11(b)

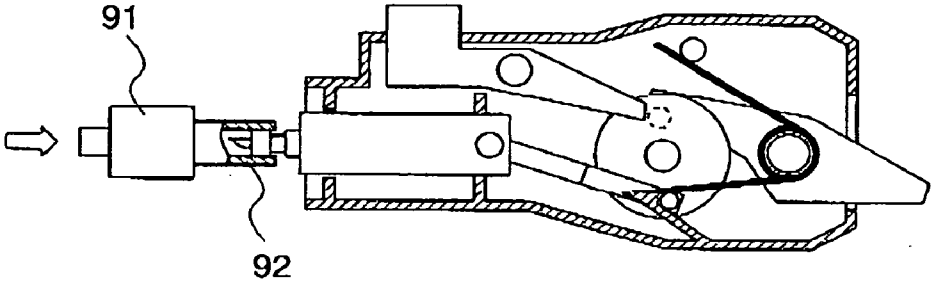


Fig.11(c)

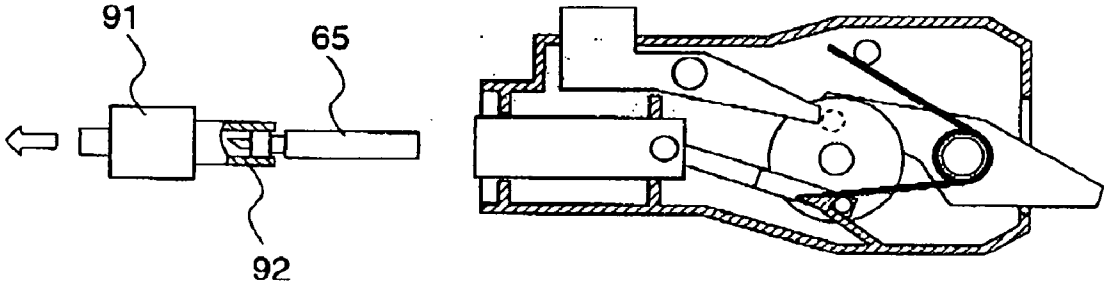


Fig.12

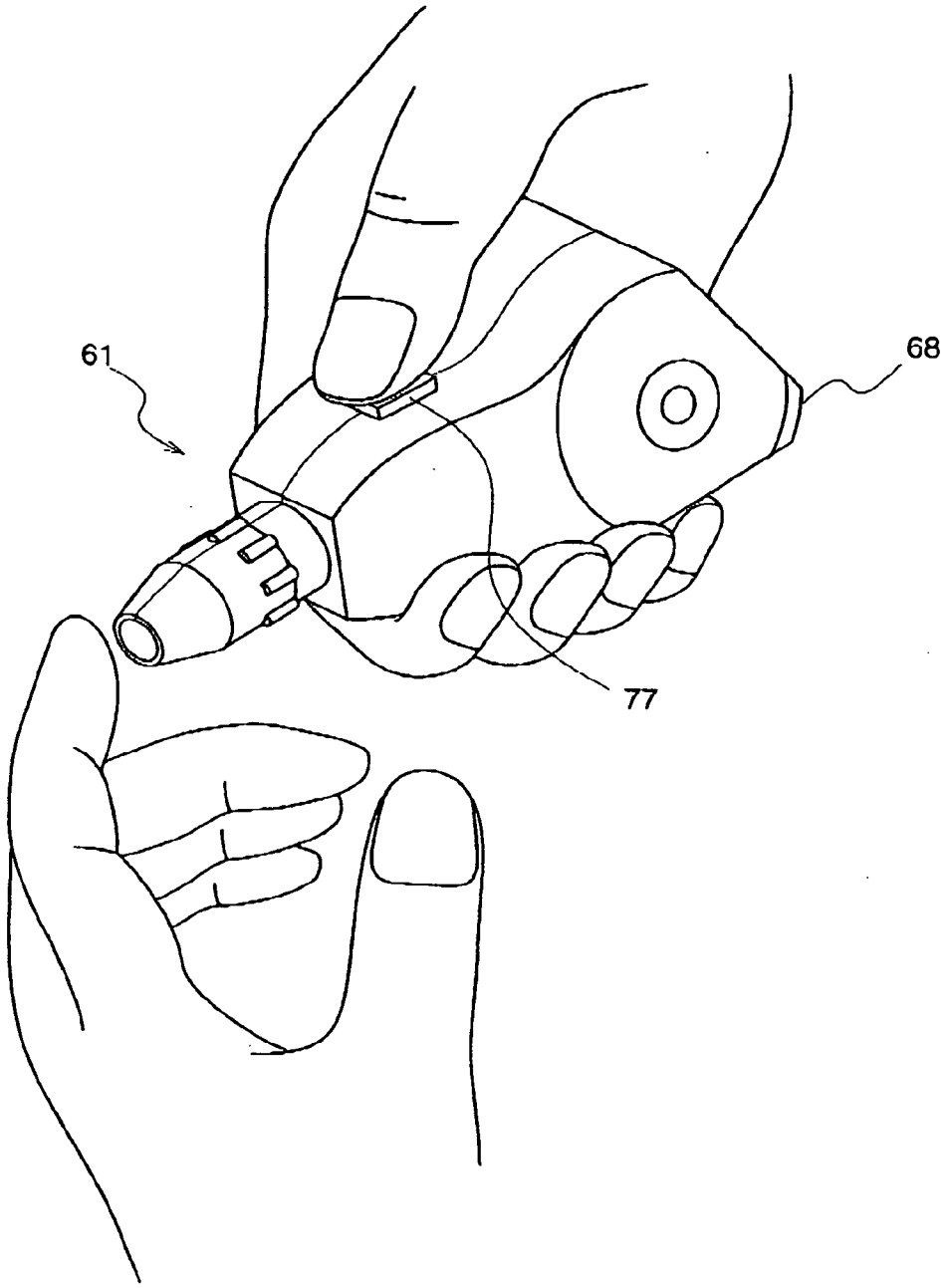
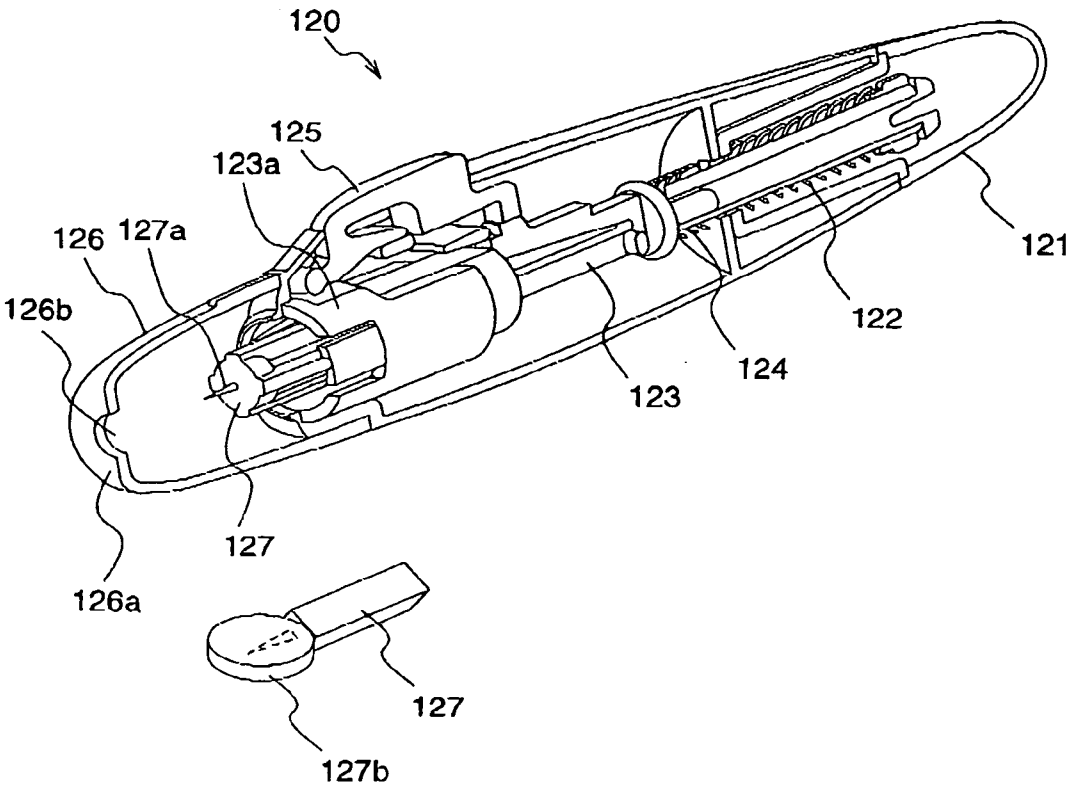


Fig.13 Prior Art



LANCET FOR BLOOD COLLECTION AND PUNCTURE NEEDLE UNIT

FIELD OF THE INVENTION

[0001] The present invention relates to a lancet for blood collection and a puncture needle unit, which are used for measuring blood sugar or the like. More specifically, the invention relates to a technique for performing puncture using the lancet, and a technique for attaching/detaching the puncture needle unit to/from the lancet.

BACKGROUND OF THE INVENTION

[0002] A conventional lancet will be described with reference to **FIG. 13**. A disposal puncture needle **127** is attached to a lancet **120**, and a fingertip or arm of a patient is punctured with a needle **127**A provided at the front end of the puncture needle **127** to collect blood from the punctured portion. The typical lancet **120** comprises a cylindrical body **121**, and a cap **126**. A slidable puncture rod **123** for holding the puncture needle **127** is incorporated in the body **121**, and the puncture rod **123** has a first spring **122** for projecting the attached puncture needle **127**, a second spring **124** for backing off the projected puncture needle **127**, and a launch button **125** for releasing the compressed first spring **122**.

[0003] The lancet **120** is used as follows. Initially, the cap **126** is removed from the body **121**, and the puncture needle **127**, from which a protection cap **127**B is twisted and removed, is attached to the puncture rod **123** incorporated in the body, and the cap **126** is again put on the body. Then, the first spring **122** is compressed to set the lancet **120** in a state where puncture is possible (puncture-ready state), and a puncture target pressing surface **126**A of the cap **126** is applied to a target to be punctured, such as a fingertip. When the launch button **125** is pressed, the puncture rod **123** slides, and simultaneously, the puncture needle **127** attached to a holder **123**A also slides, and the puncture needle **127** hits the inner wall of the cap **126**. At this time, the tip of the needle **127**A slightly protrudes from a puncture hole **126**B, and punctures the fingertip or the like. Thereafter, the puncture needle **127** is immediately removed from the fingertip or the like by the second spring **124**. Thereby, the lancet **122** collects blood. (Refer to Japanese Published Patent Application No. 2000-237172 (Pages 3 and 4, **FIG. 1**).)

[0004] In the conventional lancet, however, in order to execute the puncture operation, initially the puncture needle housed in the blood collection device (lancet) is once held at a position where the first spring is charged and then released, whereby the puncture needle is displaced in the puncture direction, i.e., it moves toward a body region to be punctured. After the puncture needle hits the lancet body, the puncture needle is backed off to the initial position by the function of the second spring, and stopped. According to this method, shock, sound, and vibration during puncture are considerable. Further, since the puncture needle vibrates due to the balance of the spring forces, the puncture needle might puncture the same portion or its vicinity a few times. Further, when attaching or detaching the puncture needle to/from the lancet, the needle is unprotected because it is not covered with the protection cap, and the puncture rod easily moves because it is held by only the spring, leading to puncture by mistake.

SUMMARY OF THE INVENTION

[0005] The present invention is made to solve the above-mentioned problems and has for its object to provide a lancet for blood collection and a puncture needle unit, which are able to reduce pain and fear of a patient due to shock, sound, and vibration when performing puncture using a puncture needle, and prevent the puncture needle from puncturing the same portion a few times, and further, ensure excellent usability and handleability with safety.

[0006] Other objects and advantages of the invention will become apparent from the detailed description that follows. The detailed description and specific embodiments described are provided only for illustration since various additions and modifications within the scope of the invention will be apparent to those of skill in the art from the detailed description.

[0007] According to a first aspect of the present invention, there is provided a lancet for puncturing a human body with a puncture needle to collect bodily fluids from the human body, comprising: a slider which is able to hold a puncture needle at one end, and is reversibly slidable in a linear direction so that a puncture operation by the puncture needle is carried out; a cam ring which is flat-shaped and rotatable about its axis, has a cam groove that is engaged with a cam follower provided on the slider within its rotation plane, and slides the slider by its rotation operation; an elastic force application member for applying a rotation force in a predetermined direction to the cam ring to slide the slider in a puncture direction; a stopper arm for stopping the rotation of the cam ring to which a force is applied by the elastic force application member, or releasing the stopping; and an anti-reverse-rotation mechanism which is implemented by a ratchet mechanism for preventing reverse rotation of the cam ring after the puncture operation. Therefore, it is possible to provide a lancet for blood collection which reduces shock, sound, and vibration during puncture, prevents plural times of puncture by a puncture needle, gives less pain and fear to a patient, and is highly operable and safely handleable.

[0008] According to a second aspect of the present invention, in the lancet according to the first aspect, the anti-reverse-rotation mechanism releases the stopping of rotation of the cam ring to which a force is applied by the elastic force application member, by the releasing operation of the stopper arm; and when the slider moves with the rotation of the cam ring and thereby a puncture operation is carried out and then the slider moves in a direction that goes apart from the puncture direction with further rotation of the cam ring, the anti-reverse-rotation mechanism restricts the rotation of the cam ring in one direction so as to prevent the slider from moving in the puncture direction again. Therefore, it is possible to restrict rotation of the cam ring in one direction.

[0009] According to a third aspect of the present invention, in the lancet according to the first aspect, the stopper arm has a stopper claw that contacts a cam ring claw of the cam ring, in a puncture-ready position where the puncture needle is backed off into the lancet, and a rotation force applied to the cam ring by the elastic force application member is active; when the stopper arm is pressed and rotated in the above-mentioned state, the contact of the stopper claw of the stopper arm and the cam ring claw is released, whereby the cam ring rotates in a predetermined position; and when the slider slides in the puncture direction by the rotation of the cam ring and thereby the cam ring rotates exceeding a maximum protrusion position of the

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puncture needle, an anti-reverse claw of the cam ring passes over a ratchet claw of the ratchet mechanism while bending the ratchet mechanism, and catches the ratchet claw to prevent the cam ring from rotating in the opposite direction. Therefore, it is possible to provide a lancet for blood collection which prevents plural times of puncture by a puncture needle, gives less pain and fear to a patient, and is highly operable and safely handleable.

[0010] According to a fourth aspect of the present invention, in the lancet according to the first aspect, the stopper arm has a stopper for restricting the amount of rotation of the stopper arm toward the cam ring; and the ratchet has a stopper for restricting the amount of rotation of the ratchet toward the cam ring. Therefore, reliabilities of operations of the stopper arm and the ratchet are respectively increased, and an excessive load on the cam ring due to friction is eliminated.

[0011] According to a fifth aspect of the present invention, the lancet as defined in claim **1** further comprising: a set ring which is rotatably provided on the same axis as the cam ring; and a force transfer mechanism for transferring a rotation force of the set ring only in one direction; wherein the rotation force of the set ring is transferred to the cam ring through the force transferring mechanism. Therefore, the slider is reliably held when setting or removing a puncture needle. In addition, operability and reliability for setting a puncture needle in a puncture-ready state are increased.

[0012] According to a sixth aspect of the present invention, in the lancet according to the first aspect, the elastic force application member is implemented by a ring spring. Therefore, it is possible to efficiently apply a force to the cam ring with a simple construction.

[0013] According to a seventh aspect of the present invention, there is provided a lancet for puncturing a human body with a puncture needle to collect bodily fluids from the human body, comprising: a slider which is able to hold a puncture needle at one end, and is reversibly slidable in a linear direction so that a puncture operation by the puncture needle is carried out; a link mechanism which is coupled to the other end of the slider; a flywheel which is mounted rotatably with respect to the link mechanism, and is coupled to the link mechanism by implanting a rotation knot shaft as a shaft on the other end of the link mechanism coupled to the slider, in the flywheel; an elastic force application member for applying a rotation force in a predetermined direction to the flywheel to slide the slider in a puncture direction through the link mechanism; a stopper arm for stopping the rotation of the flywheel to which a force is applied by the elastic force application member, or releasing the stopping; a set lever mechanism which is engaged with a wheel set pin provided on the flywheel, and rotates the flywheel only in one direction, thereby setting the slider in a puncture-ready position; and an anti-reverse-rotation mechanism which prevents reverse rotation of the flywheel after the puncture operation. Therefore, it is possible to provide a lancet for blood collection which reduces shock, sound, and vibration during puncture, prevents plural times of puncture by a puncture needle, gives less pain and fear to a patient, and is highly operable and safely handleable.

[0014] According to an eighth aspect of the present invention, in the lancet according to the seventh aspect, the anti-reverse-rotation mechanism releases the stopping of rotation of the flywheel to which a force is applied by the elastic force application member, by the releasing operation of the stopper arm; and when the slider moves with the rotation of the flywheel and thereby a puncture operation is carried out and then the slider moves in a direction that goes apart from the puncture direction with further rotation of the flywheel, the anti-reverse-rotation mechanism restricts the rotation of the flywheel in one direction so as to prevent the slider from moving in the puncture direction again. Therefore, it is possible to prevent reverse rotation of the flywheel.

[0015] According to a ninth aspect of the present invention, in the lancet according to the seventh aspect, the stopper arm has a stopper claw that contacts the rotation knot shaft implanted in the flywheel, in a puncture-ready position where the puncture needle is backed off into the lancet, and a rotation force applied to the flywheel by the elastic force application member is active; when the stopper arm is pressed and rotated in the above-mentioned state, the contact of the stopper claw of the stopper arm and the rotation knot shaft is released, whereby the flywheel rotates in a predetermined position; and when the slider slides in the puncture direction by the rotation of the flywheel through the link mechanism and thereby the flywheel rotates exceeding a maximum protrusion position of the puncture needle, the rotation knot shaft passes over an anti-reverse-rotation claw of the anti-reverse-rotation mechanism while bending the anti-reverse-rotation mechanism, and catches the anti-reverse-rotation claw to prevent the flywheel from rotating in the opposite direction. Therefore, it is possible to provide a lancet for blood collection which reduces shock, sound, and vibration during puncture, prevents plural times of puncture by a puncture needle, gives less pain and fear to a patient, and is highly operable and safely handleable.

[0016] According to a tenth aspect of the present invention, in the lancet according to the seventh aspect, the set lever mechanism is provided with an elastic member for returning the set lever mechanism back to the initial state when the contact of the front end of the stopper arm with the rotation knot shaft is released. Therefore, it is possible to reduce the rotation load of the flywheel during the puncture operation.

[0017] According to an eleventh aspect of the present invention, in the lancet according to the seventh aspect, the rotation knot shaft is constituted as a catch mechanism for puncture preparation in which the slider is fixed to a start position of one reciprocating operation of the slider in its axis direction, by being engaged with the front end of the stopper arm. Therefore, it is possible to efficiently stop the rotation of the flywheel.

[0018] According to a twelfth aspect of the present invention, in the lancet according to the eleventh aspect, the elastic force application member applies a force to the rotation knot shaft so as to rotate the flywheel around its axis in a predetermined rotation direction. Therefore, it is possible to efficiently apply a force to the flywheel with a simple construction.

[0019] According to a thirteenth aspect of the present invention, in the lancet according to the eleventh aspect, the elastic force application member for applying a force to the rotation knot shaft is implemented by a kick spring. Therefore, it is possible to reliably obtain a driving force for linearly sending a puncture needle to a puncture position, with a simple construction.

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[0020] According to a fourteenth aspect of the present invention, in the lancet according to the eleventh aspect, in the puncture-ready state, the center of the rotation knot shaft is located on the slider side with respect to the rotation center of the flywheel. Therefore, it is possible to carry out puncture after the flywheel is stopped completely.

[0021] According to a fifteenth aspect of the present invention, in the lancet according to any of the first to fourteenth aspects, wherein the puncture needle has a safety claw which is engaged with the inner surface of an external case of the lancet to prevent the puncture needle from dropping when the puncture needle is detached from the lancet. Therefore, it is possible to provide a lancet for blood collection which can be handled more safely.

[0022] According to a sixteenth aspect of the present invention, in the lancet according to the first or seventh aspect, the slider has a fitting and fixing hole for fixing the puncture needle; and the puncture needle is a puncture needle unit comprising a puncture needle body and a puncture needle cap, and the puncture needle body has a puncture needle main part having a needle at its front end, a protrusion to be fitted and fixed to the fitting and fixing hole, at an external surface of a base portion of the puncture needle main part, and a rotation stop rib for the puncture needle cap that covers the puncture needle body, at a side surface of an upper portion of the puncture needle body; and the puncture needle cap is fitted to the rotation stop rib and is lightly pressed into the puncture needle body to cover the puncture needle body. Therefore, it is possible to provide a lancet for blood collection and a puncture needle unit, which reduce shock, sound, and vibration during puncture, prevent plural times of puncture by a puncture needle, give less pain and fear to a patient, and are highly operable and safely handleable.

[0023] According to a seventeenth aspect of the present invention, in the lancet according to the sixteenth aspect, in the puncture needle unit, the puncture needle main part is snugly fitted and attached to the lancet with the puncture needle cap being attached to the puncture needle body part; and after the puncture needle main part is attached to the lancet, the puncture needle cap is removed from the puncture needle main part. Therefore, it is possible to provide a lancet and a puncture needle unit which are able to safely set a puncture needle.

[0024] According to an eighteenth aspect of the present invention, in the lancet according to the sixteenth aspect, the puncture needle unit detaches the puncture needle main part from the lancet as follows: the puncture needle cap is pressed in and snugly fitted to the puncture needle main part after performing the puncture operation; and the puncture needle main part is removed together with the puncture needle cap from the lancet body together. Therefore, it is possible to provide a lancet and a puncture needle unit which are able to safely discard a used puncture needle.

[0025] According to a nineteenth aspect of the present invention, in the lancet according to the sixteenth aspect, the puncture needle cap is cylindrical in shape, and has protection slots for protecting the puncture needle after performing the puncture operation from the lancet body, which slots are formed from both of an end and the other end of the cylindrical shape. Therefore, it is possible to safely discard a used puncture needle.

[0026] According to a twentieth aspect of the present invention, in the lancet according to the sixteenth aspect, the puncture needle cap is cylindrical in shape, and has a protection slot for protecting the puncture needle, which is formed from an end of the cylindrical shape, and a disposal slot for taking the puncture needle after performing the puncture operation from the lancet body and discarding the needle, which is formed from the other end of the cylindrical shape, and fitting of the puncture needle to the disposal slot is easier than fitting of the puncture needle to the protection slot. Therefore, it is possible to easily and safely discard a used puncture needle.

[0027] According to a twenty-first aspect of the present invention, in the lancet according to the twentieth aspect, the disposal slot of the puncture needle cap has an opening that is larger than an opening of the protection slot. Therefore, it is possible to easily and safely discard a used puncture needle.

[0028] According to a twenty-second aspect of the present invention, in the lancet according to the sixteenth aspect, the puncture needle body has a safety claw which is engaged with the inner surface of an external case of the lancet to prevent the puncture needle from dropping when the puncture needle body is detached from the lancet; and the puncture needle cap is lightly pressed into the puncture needle body while being fitted to the safety claw, to cover the puncture needle body. Therefore, it is possible to provide a lancet for blood collection which can be handled more safely.

[0029] According to a twenty-third aspect of the present invention, there is provided a puncture needle Unit comprising: a puncture needle body, and a puncture needle cap, the puncture needle body having a puncture needle main part having a needle at its front end, a protrusion to be fitted and fixed to a fitting and fixing hole provided on the lancet body, which protrusion is provided on an external surface of a base portion of the puncture needle main part, and a rotation stop rib for the puncture needle cap that covers the puncture Wheedle body, which rib is provided on a side surface of an upper portion of the puncture needle body; and the puncture needle cap being fitted to the rotation stop rib and lightly pressed into the puncture needle body to cover the puncture needle body. Therefore, it is possible to provide a puncture needle unit which reduces shock, sound, and vibration during puncture, prevents plural times of puncture by a puncture needle, gives less pain and fear to a patient, and is highly operable and safely handleable.

[0030] According to a twenty-fourth aspect or the present invention, in the puncture needle unit according to the twenty-third aspect, the puncture needle body has a safety claw that is engaged with the inner surface of an external case of the lancet to prevent the puncture needle from dropping when the puncture needle is detached from the lancet; and the puncture needle cap is lightly pressed into the puncture needle body while being fitted to the safety claw, to cover the puncture needle body. Therefore, it is possible to provide a puncture needle unit which can be handled more safely.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] **FIG. 1** is a plane view of a lancet according to a first embodiment of the present invention, illustrating a state where puncture is ready.

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[0032] **FIG. 2** is a plane view of the lancet according to a first embodiment, illustrating a state where puncture is ready, wherein some of main parts are changed.

[0033] **FIG. 3**(*a*) is a perspective view of a puncture needle unit according to the first embodiment, wherein a puncture needle body and a puncture needle cap are united.

[0034] **FIG. 3**(*b*) is a perspective view of the puncture needle unit according to the first embodiment, wherein the puncture needle body and the puncture needle cap are separated.

[0035] **FIG. 3**(*c*) is a perspective view of the puncture needle unit according to the first embodiment, wherein the lancet, the puncture needle body, and the puncture needle cap are separated.

[0036] **FIG. 4**(*a*) is a plane view illustrating a puncture operation of the lancet according to the first embodiment, illustrating a puncture needle set position.

[0037] **FIG. 4**(*b*) is a plane view illustrating the puncture operation of the lancet according to the first embodiment, illustrating a puncture operation ready position.

[0038] **FIG. 4**(*c*) is a plane view illustrating the puncture operation of the lancet according to the first embodiment, illustrating a puncture position where the puncture needle protrudes at maximum.

[0039] **FIG. 5**(*a*) is a side view of the lancet according to the first embodiment.

[0040] **FIG. 5**(*b*) is a side view of the lancet according to the first embodiment, illustrating a part of the lancet in detail.

[0041] **FIG. 6** is an external perspective view of a lancet according to a second embodiment of the present invention.

[0042] **FIG. 7**(*a*) is a cross-sectional view of the internal structure of the lancet according to the second embodiment.

[0043] **FIG. 7**(*b*) is a top view of the internal structure of the lancet according to the second embodiment.

[0044] **FIG. 8** is a perspective view illustrating a puncture needle unit to be used for the lancet according to the second embodiment.

[0045] **FIG. 9**(*a*) is a diagram illustrating a method for loading a puncture needle on the lancet according to the second embodiment.

[0046] **FIG. 9**(*b*) is a diagram illustrating the method for loading the puncture needle on the lancet according to the second embodiment.

[0047] **FIG. 9**(*c*) is a diagram illustrating the method for loading the puncture needle on the lancet according to the second embodiment.

[0048] **FIG. 10**(*a*) is a diagram illustrating a method for preparing the lancet for puncture according to the second embodiment.

[0049] **FIG. 10**(*b*) is a diagram illustrating the method for preparing the lancet for puncture according to the second embodiment.

[0050] **FIG. 10**(*c*) is a diagram illustrating the method for preparing the lancet for puncture according to the second embodiment.

[0051] **FIG. 11**(*a*) is a diagram illustrating a method for discarding a puncture needle attached to the lancet according to the second embodiment.

[0052] **FIG. 11**(*b*) is a diagram illustrating the method for discarding the puncture needle attached to the lancet according to the second embodiment.

[0053] **FIG. 11**(*c*) is a diagram illustrating a method for discarding the puncture needle attached to the lancet according to the second embodiment.

[0054] **FIG. 12** is a perspective view illustrating a puncture operation by the lancet according to the second embodiment.

[0055] **FIG. 13** is a perspective view illustrating the conventional lancet.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0056] Hereinafter, lancets according to embodiments of the present invention will be described with reference to the drawings.

[0057] [Embodiment 1]

[0058] **FIG. 1** is a plane view illustrating a lancet in a puncture-ready state, according to a first embodiment of the present invention.

[0059] In **FIG. 1**, a lancet body **1** according to the first embodiment has a bottom case **2** as a base, and various kinds of parts are incorporated in the bottom case **2**. A slider **3** has a puncture needle fixing hole **3***a* in which a puncture needle body **4***a* is inserted, a slide groove **3***b* that guides the slider **3**, and a cam follower **3***c* to be guided by a cam groove **5***b*, and the slider **3** is reversibly slidable in the longitudinal direction.

[0060] The puncture needle body **4***a* has, at an end thereof, a needle **4***c* that is able to puncture a fingertip or the like, and an elastic safety claw **4***f*. The puncture needle body **4***a* is inserted in the puncture needle fixing hole **3***a* of the slider **3**.

[0061] A cam ring **5** is flat in shape, and rotatable about a cam ring support shaft **5***a*. The cam ring **5** has the continuous cam groove **5***b* within its rotation plane, and the cam groove **5***b* guides the cam follower **3***c*. The cam ring **5** slides the slider **3** by its own rotation. A cam ring claw **5***c* is provided at the outer circumference of the cam ring **5**, and temporarily holds rotation of the cam ring **5** in combination with a stopper arm **6** described later. An anti-return claw **5***d* provided at the outer circumference of the cam ring **5** has a height different from that of the cam ring claw **5***c*, and restricts the rotation direction of the cam ring **5** in combination with a ratchet **7** for preventing reverse rotation of the cam ring **5**. A cam ring pin **5***e* has a groove, and is press-fitted into the cam ring **5**.

[0062] A stopper arm **6** is rotatable about a stopper arm support shaft **2***a* that is integrally molded with the bottom case **2**. The stopper arm **6** has a stopper claw **6***a* for fixing the cam ring claw **5***c* at an end, and a stopper arm button **6***b* at the other end, and stops the rotation of the cam ring **5** or

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releases the stopping with operation of the stopper arm button **6***b*. Further, the stopper claw **6***a* and the anti-return claw **5***d* have different heights, and therefore, these claws are never engaged with each other. A stopper arm spring **6***c* is a plastic spring that is integrally molded with the stopper arm **6**, and lightly applies a force to the stopper arm **6** clockwise.

[**0063**] While in this first embodiment a plastic spring is used as the stopper arm spring **6***c,* the stopper arm spring is not restricted thereto. Any spring may be used so long as it can restrict the rotation of the stopper arm. For example, as shown in **FIG. 2**, instead of the stopper arm spring **6***c,* a stopper arm spring **9** that is a metal spring may be hanged between the bottom case **2** and the stopper arm **6** to lightly apply a clockwise force to the stopper arm **6**. Further, the stopper arm pin **2***d* may be integrally molded with the bottom case **2**, and the stopper arm pin **2***d* may serve us a stopper for restricting the amount of clockwise rotation of the stopper arm **6**. Thereby, reliability of the operation of the stopper arm **6** is improved, and excessive load on the cam ring **5** due to friction is eliminated.

[**0064**] The ratchet **7** is rotatable about a ratchet support shaft **2***b* that is integrally molded with the bottom case **2**, and has, at an end thereof, a ratchet claw **7***a* that engages with the anti-return claw **5***d* of the cam ring **5**. The ratchet **7** releases stopping of rotation of the cam ring **5** by the releasing operation of the stopper arm **6**. After the slider **3** moves with the rotation of the cam ring **5** and thereby puncture is carried out, when the slider **3** moves away from the puncture needle by the further rotation of the cam ring **5**, the ratchet **7** restricts the rotation of the cam ring **5** in one direction so as to prevent the slider **3** from again moving in the puncture direction. The ratchet claw **7***a* is of a height different from that of the cam ring claw **5***c* and, therefore, these claws are never engaged with each other. A ratchet spring **7***b* is a plastic spring that is integrally molded with the ratchet **7**, and lightly applies a force to the ratchet **7** clockwise.

[**0065**] While in this first embodiment a plastic spring is used as the ratchet spring **7***b,* the ratchet spring is not restricted thereto. Any spring may be used so long as it can lightly apply a force to the cam ring. For example, as shown in **FIG. 2**, instead of the ratchet spring **7***b,* a ratchet spring **10** that is a metal spring may be hanged between the bottom case **2** and the ratchet **7** to lightly apply a clockwise force to the ratchet **7**. Further, a ratchet pin **2***e* may be integrally molded with the bottom case **2**, and the ratchet pin **2***e* may serve as a stopper for restricting the amount of clockwise rotation of the ratchet **7**. Thereby, reliability of the operation of the ratchet **7** is improved, and excessive load on the cam ring **5** due to friction is eliminated, whereby the operation of the lancet body becomes smoother.

[**0066**] A ring spring **8** is dangled between a ring spring shaft **2***c* and the cam ring pin **5***e,* and applies a force counterclockwise to the cam ring **5** in the state shown in **FIG. 1** to slide the slider **3** in the puncture direction.

[**0067**] A puncture needle stopper **2***f* hitches on the safety claw **4***f* even when the puncture needle body **4***a* is detached from the slider **3**.

[**0068**] Next, a puncture needle unit to be used for the lancet **1** according to the first embodiment will be described.

[**0069**] FIGS. **3**(*a*) to **3**(*c*) are diagrams illustrating a puncture needle unit according to the first embodiment of the present invention, and the puncture needle unit has, at an end thereof, a puncture needle body, and a cap that covers the puncture needle body. To be specific, **FIG. 3**(*a*) is a perspective view illustrating the puncture needle body and the cap which are united to each other, **FIG. 3**(*b*) is a perspective view illustrating the puncture needle body and the cap which are separated from each other, and **FIG. 3**(*c*) is a perspective view illustrating the lancet, the puncture needle body, and the cap which are separated from each other.

[**0070**] Reference numeral **4** denotes the puncture needle unit in which the cap **4***e* is lightly press-fitted to the puncture needle body **4***a*. The puncture needle body **4***a* has a protrusion **4** at an outer surface of a base part thereof, a rotation stop rib **4***d* at a side surface of an upper part thereof, and a needle **4***c* at an end. The puncture needle cap **4***e* can be snugly fitted to the puncture needle body **4***a,* and a slot **4***g* that protects the puncture needle is formed in accordance with the rotation stop rib **4***d*. Safety claws **4***f* are implemented by, for example, plastic springs that are elastic and integrally molded with the puncture needle body **4***a*. When the cap de is pulled out, tho safety claws **4***f* expand outward. The safety claws also function as rotation stop ribs **4***d*.

[**0071**] Like the puncture needle cap **4***e* shown in **FIG. 3**(*b*), two slots **4***g* of the same shape may be formed from the both ends of the cap. Alternately, like the cap **4***e* shown in **FIG. 3**(*c*), two slots of different shapes may be formed, i.e., a slot **4***g* of the same shape as that shown in **FIG. 3**(*b*) is formed at an end of the cap while a disposal slot **4***h* of a different shape is formed at the other end of the cap. The use of the puncture cap **4***e* facilitates handling of the puncture needle body **4***a* when discarding the puncture needle body. That is, the slot **4***h* of the puncture needle cap **4***e* has a larger release opening so as to facilitate insertion of the rotation stop rib **4***d* or the safety claw **4***f,* when the puncture needle body **4***a* is pulled out of the puncture needle fixing hole **3***a* formed in the slider **3** after puncture has been completed.

[**0072**] Further, at an end of the slider **3**, a puncture needle fixing hole **3***a* as shown in **FIG. 3**(*c*) is provided, in which a catch claw **3***d* for catching the protrusion **4***b* is formed.

[**0073**] FIGS. **4**(*a*)-**4**(*c*) are plane views for explaining the puncture operation of the lancet according to the first embodiment of the invention. To be specific, **FIG. 4**(*a*) shows the puncture needle set position where the ring spring is compressed at maximum, **FIG. 4**(*b*) shows the puncture-ready position, and **FIG. 4**(*c*) shows the puncture position where the puncture needle protrudes at maximum.

[**0074**] The operation will be described with reference to FIGS. **4**(*a*)-**4**(*c*).

[**0075**] Initially, the puncture needle unit **4** in the state where the puncture needle body and the puncture needle cap shown in **FIG. 3**(*a*) or **3**(*b*) are united is inserted into the lancet body **1** as shown in **FIG. 3**(*c*), and the puncture needle unit **4** is snugly fitted to the puncture needle fixing hole **3***a* of the slider **3**, thereby setting the lancet **1** at the position shown in **FIG. 4**(*a*). With reference to **FIG. 4**(*a*), at the position where the shape of the slider **3** fits the shape of the puncture needle body **4***a,* the puncture needle unit **4** is inserted deeply, and the puncture needle cap **4***e* is rotated clockwise to sink the protrusion **4***b* into the catch claw **3***d*. Although the puncture needle body **4***a* is lightly press-inserted into the cap **4***e,* the puncture needle unit **4** can be reliably rotated by the rotation stop rib **4***d* or the safety claw **4***f,* and the slot **4***g*.

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[0076] Thereafter, when the puncture needle cap **4***e* is pulled out, the puncture needle body **4***a* remains on the slider **3** side, and the needle **4***c* is exposed. However, the needle **4***c* is housed in the bottom case **2** of the lancet body **1**. If the engagement of the protrusion **4***b* and the catch claw **3***d* is not tight, when the puncture needle cap **4***e* is pulled out, the puncture needle body **4***a* is pulled out together with the cap **4***e,* and the puncture needle body **4***a* is not set on the slider **3**.

[0077] Further, in the case of the puncture needle unit shown in **FIG. 3**(*b*), when the puncture needle cap **4***e* is pulled out after performing the same operation as mentioned above, the elastic safety claw opens toward the outer circumference. Therefore, even when the engagement of the protrusion **4***b* and the catch claw **3***d* is released, the puncture needle body **4***a* interferes with the puncture needle stopper **2***f* and thereby it is not pulled out, resulting in more safety.

[0078] After the puncture needle body **4***a* is set in the position shown in **FIG. 4**(*a*), the cam ring **5** is rotated counterclockwise up to the puncture-ready position wherein the puncture needle is backed off into the lancer and a force applied to the cam ring **5** by the ring spring **8** to rotate the cam ring **5** acts, as shown in **FIG. 4**(*b*), using a set ring described later or the like.

[0079] Next, the operation for rotating the cam ring **5** up to the puncture-ready position will be described with reference to FIGS. **5**(*a*) and **5**(*b*).

[0080] **FIG. 5**(*a*) is a side view of the lancet according to the first embodiment, and **FIG. 5**(*b*) shows a portion of the lancet in detail.

[0081] In FIGS. **5**(*a*) and **5**(*b*), a set ring **12** is concentric with the cam ring support shaft **5***a,* and a clutch spring **11** for transferring the rotation force of the set ring **12** is snugly engaged and incorporated in the set ring support shaft **12***a* and the cam ring support shaft **5***a*. An end leg **11***a* of the clutch spring **11** is inserted between two fixed bosses **12***b* provided on the set ring **12**, and fixed. As shown in **FIG. 5**(*b*), when the set ring **12** is rotated in the right-hand thread direction (shown by an arrow in **FIG. 5**(*b*)), the clutch spring **11** is tightened, and the cam ring support shaft **5***a* is rotated together, whereby the cam ring **5** is rotated counterclockwise in **FIG. 4**(*a*). On the other hand, when the set ring **12** is rotated in the left-handed thread direction (opposite direction to the arrow in **FIG. 5**(*b*)), the clutch spring **11** is loosened, and the cam ring support shaft **5***a* turns free, and thereby the cam ring **5** is not rotated. That is, the cam ring **5** can be rotated through the clutch spring **11**, by rotating the set ring **12** counterclockwise.

[0082] By adding these elements, operability and reliability of the lancet body can be further improved.

[0083] After the puncture needle body **4***a* is set to the slider **3** in the position shown in **FIG. 4**(*a*), the set ring **12** is rotated counterclockwise until the cam ring claw **5***c* of the cam ring **5** contacts the stopper claw **6***a* of the stopper arm **6**, resulting in a puncture possible state. At this time, if the set ring **12** is rotated clockwise, the clutch spring **11** is loosened, and the cam ring **5** turns free. While in this first embodiment the power of the set ring **12** is transferred to the cam ring **5** using the clutch spring **11**, the present invention is not restricted thereto. Any mechanism may be employed so long as it can transfer the power of the set ring **12** in one direction. Further, the set ring is not restricted to that described above. Any mechanism may be employed so long as it can rotate the cam ring **5** from the outside of the lancet **1**.

[0084] Through the above-mentioned operation, the lancet **1** is set in the puncture operation ready state shown in **FIG. 4**(*b*). Then, the stopper arm button **6***b* of the stopper arm **6** is pressed at the puncture operable position, whereby the stopper art is rotated counterclockwise, and the engagement of the stopper claw **6***a* and the cam ring claw **5***c* is released. Since the cam ring **5** is given a force counterclockwise by the ring spring **8**, the cam follower **3***c* is positioned on the inclined part exceeding the inflection point at which the radius of the cam groove **5***b* changes. Therefore, the cam ring **5** starts to rotate counterclockwise. The cam follower **3***c* is guided by the cam groove **5***b,* the slider **3** slides in the puncture direction, and the needle **4***c* attached to the puncture needle body **4***a* also slides in the puncture direction.

[0085] **FIG. 4**(*c*) shows the puncture position wherein the needle **4***c* of the puncture needle body **4***a* protrudes at maximum from the lancet body **1**, and puncture of a fingertip or the like is possible. From this position, the cam ring **5** is further rotated counterclockwise by both of the rotation force of the cam ring **5** and the counterclockwise force applied to the cam ring **5** by the ring spring **8**, and stops at the puncture needle set position shown in **FIG. 4**(*a*) wherein the ring spring **8** is compressed at maximum. This position is a flat position exceeding the inflection point at which an area where the radius of the cam groove **5***b* changes is changed to an area where the radius of the cam groove **5***b* does not change. In this position, the slider is guided in the direction opposed to the puncture direction by the cam follower **3***c* guided by the cam groove **5***b,* and the puncture needle body **4***a* is recessed at maximum.

[0086] In the position shown in **FIG. 4**(*a*), the ring spring **8** does not generate a force for rotating the cam ring **5**, and the cam ring **5** is most stable. If the cam ring rotates counterclockwise from the position of **FIG. 4**(*a*), the ring spring **8** generates a force for rotating the cam ring **5** clockwise, whereby the cam ring **5** returns to the position of **FIG. 4**(*a*).

[0087] Usually, in this position, the puncture needle body **4***a* is attached or detached to/from the puncture needle fixing hole of the slider **3**. At this time, the cam follower **3***c* of the slider **3** is guided into the cam groove **5***b,* whereby the slider **3** is firmly held so as not to move.

[0088] Further, in a position between **FIG. 4**(*c*) and **FIG. 4**(*a*), the anti-return claw **5***d* formed on the cam ring **5** passes so that the ratchet claw **7***a* formed on the ratchet **7** is bent by the anti-return claw **5***d.* Therefore, even when the cam ring **5** starts to rotate clockwise, the anti-return claw **5***d* is engaged with the ratchet claw **7***a* to prevent the cam ring **5** from rotating clockwise. Accordingly, plural times of puncture onto a fingertip or the like by the needle **4***c* never occur.

[0089] When the puncture has been completed, in the position shown in **FIG. 4**(*a*), the puncture needle cap **4***e* is inserted deeply into the lancet body **1**, and the slot **4***g* or the disposal slot **4***h* is engaged with the rotation stop rib **4***d* or the safety claw **4***f* of the puncture needle body. When the puncture needle cap **4***e* is rotated counterclockwise, the protrusion **4***b* is released from the catch claw **3***d.* Thereafter,

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the puncture needle cap **4***e* is pulled out, the puncture needle body **4***a,* which is press-inserted into the cap **4***e,* is pulled out together with the cap **4***e*. Of course, the needle **4***c* is protected by the cap **4***e*.

[**0090**] As described above, the lancet according to the first embodiment comprises the slider **3** which has the puncture needle holding mechanism at its one end; the cam ring **5** which has the continuous cam groove **5***b,* is rotatable about the support shaft, and has the claw for restricting the rotation; the ring spring **8** which applies a force to rotate the cam ring **5**; the stopper arm **6** which is rotatable and is able to hold and release the rotation of the cam ring **5**; and the ratchet **7** which is rotatable and restricts the direction of rotation of the cam ring **5**. Further, the puncture needle unit comprises the puncture needle body **4***a* which is integrally molded with the protrusion **4***b* to be fitted to the lancet body, the rotation stop rib **4***d* or the elastic safety claw **4***f,* and the puncture needle **4***c;* and the puncture needle cap **4***e* into which the puncture needle body **4***a* is lightly press-inserted. Therefore, the puncture needle never hits the lancet body during the puncture operation, and the needle itself of the puncture needle unit protrudes only one time from the lancet body. Further, during attachment or detachment of the puncture needle, the slider is reliably held, whereby shock, sound, and vibration during puncture are reduced, and plural times of puncture by the puncture needle are avoided. As a result, it is possible to provide a lancet for blood collection and a puncture needle unit, which are easily handled and give less pain and fear to a patient.

[**0091**] Further, the lancet is provided with the set ring **12** which is rotatable about the same axis as the cam ring **5**, and the clutch spring **11** for transferring the rotation force of the set ring **12** only in one direction, and the rotation force of the set spring **12** is transferred to the cam ring **5** through the clutch spring **11**. Therefore, operability and reliability of the lancet body can be further improved.

[**0092**] While in the lancet **1** of the first embodiment the ratchet **7** is employed as an anti-reverse-rotation mechanism for preventing reverse rotation of the cam ring **5** after the puncture operation, the present invention is not restricted thereto. Any means may be employed so long as it has a mechanism for preventing reverse rotation of the cam ring **5**.

[**0093**] Furthermore, while in the lancet **1** of the first embodiment the cam ring **5** is rotated using the ring spring **8**, the present invention is not restricted thereto. Any means may be employed so long as it can apply a force to the cam ring **5** to rotate the cam ring **5** in a predetermined direction.

[**0094**] [Embodiment 2]

[**0095**] **FIG. 6** is an external perspective view of a lancet according to a second embodiment of the present invention, **FIG. 7** is a cross-sectional view illustrating the internal structure of the lancet, and **FIG. 8** is an external perspective view of a puncture needle to be used for the lancet. As in the first embodiment, the lancet and the puncture needle are used to collect a small amount of blood for such as measurement of blood sugar. FIGS. **9**(*a*)-**9**(*c*) are diagrams illustrating the procedures for setting the puncture needle into the lancet to perform puncture operation.

[**0096**] As shown in **FIG. 6**, a lancet **61** according to the second embodiment is provided with a puncture depth adjustment ring **81** having a puncture needle loading slot **69** at an end, a body top case **62**, and a body bottom case **63**.

[**0097**] In the body top case **62** and the body bottom case **63**, as shown in FIGS. **7**(*a*) and **7**(*b*), there are provided a slider **64**, a link mechanism **79**, a flywheel **71**, a puncture set lever **68**, a stopper arm **77**, a flywheel set spring **73**, and the like. In the slider **64**, a puncture needle **65** is inserted up to a predetermined depth.

[**0098**] The slider **64** is able to hold the puncture needle **65** in a puncture needle fixing hole **70** which is provided at an end of the slider **64**, and is reversibly slidable in a linear direction.

[**0099**] The link mechanism **79** is coupled to the other end of the slider **64** on which the puncture needle is fixed at an end, and further, it is coupled to the flywheel **71** described later.

[**0100**] The flywheel **71** is coupled to the link mechanism **79** such that a wheel engagement pin **76** which is a rotation knot shaft to be a shaft of the other end of the link mechanism **79** coupled to the slider **64** is implanted in the flywheel **71**.

[**0101**] The flywheel set spring **73** is implemented by a kick spring, and applies a force to the flywheel **71** to rotate the flywheel **71** in a predetermined direction so as to slide the slider **64** in the puncture direction through the link mechanism **79**. While in this second embodiment a kick spring is used as the flywheel set spring **73**, the present invention is not restricted thereto. Any means may be employed so long as it can apply a rotation force in a predetermined direction to the flywheel **71**. For example, a ring spring shown in **FIG. 1** may be employed.

[**0102**] The stopper arm **77** is able to stop the rotation of the flywheel **71** to which a force is applied by the flywheel set spring **73**, or release the stopping. The stopper arm **77** is rotatable about a stopper arm support shaft **77***b* that is integrally molded with the bottom case **63**. The stopper arm **77** has, at an end, a stopper claw **77***a* which is engaged with the wheel engagement pin **76** implanted in the flywheel **71** to fix the rotation of the flywheel, and has a stopper arm button **77***c* at the other end. The stopper arm spring **75** is integrally constituted with the stopper arm **77**, and lightly applies a force to the stopper arm **77** clockwise. While in this second embodiment a kick spring as shown in **FIG. 7**(*b*) is used as the stopper arm spring **75**, the present invention is not restricted thereto. Any spring may be employed so long as it can restrict the rotation of the stopper arm **77**. For example, a plastic spring or a metal spring as shown in **FIGS. 1 and 2** according to the first embodiment may be employed.

[**0103**] The puncture needle set lever **68** is engaged with the wheel set pin **72** on the flywheel **71**, and rotates the flywheel **71** only in one direction, thereto set the flywheel **71** in a puncture-ready position.

[**0104**] Further, a puncture needle unit **90** according to the second embodiment is constituted as shown in **FIG. 8**. The puncture needle unit **90** is divided into a puncture needle body **65** and a puncture needle cap **91** with a puncture needle separation groove **65***a* as A boundary, and the body **65** and the cap **91** are connected to each other by a thin plastic film having a thickness of 0.1 mm or less in the puncture needle

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separation groove **65***a*. The puncture needle body **65** is set in a state where it is embedded in the puncture needle cap **91**, and a disposal slot **92** for pulling out the puncture needle **65** after puncture has been carried out is provided at an end of the puncture needle cap **91**. The shape of the puncture needle cap of the puncture needle unit **90** is not restricted to that shown in **FIG. 8**. For example, the puncture needle cap may have slots at the both ends thereof so that the puncture needle after the puncture operation can be inserted from the both ends, whereby setting and discarding of the puncture needle can be safely carried out from either slot. At this time, the puncture needle can be easily discarded by making the slot at the discarding side have a larger aperture.

[**0105**] Next, a description will be given of the operational procedures for setting the puncture needle **65** into the lancet **61** to prepare the lancet **61** for puncture.

[**0106**] Initially, in a state where the puncture needle set lever **68** is not set, the puncture needle loading slot **69** of the lancet **61** is fitted to the axis of the puncture needle **65**, and the puncture needle unit **90** is pushed into the puncture needle loading slot **69** of the lancet **61** (**FIG. 9**(*a*)). At this time, the puncture needle unit **90** is pushed to a position where the rear end portion of the puncture needle **65** that is guided into the slider **64** of the lancet **61** presses the bottom surface **70***a* of the puncture needle fixing hole **70** of the slider **64**. In this state, the puncture needle **65** is pressed into and snugly fitted to the inner wall of the puncture needle fixing hole **70** of the slider **64** (**FIG. 9**(*b*)). When the lancet **61** is pulled while twisting the puncture needle unit **90**, since the puncture needle **65** is snugly fitted to the puncture needle fixing hole **70**, the puncture needle **65** can be separated from the puncture needle cap **91**. At this time, a force that pulls off the thin plastic film is generated in the puncture needle separation groove **65***a* that is positioned in the vicinity of the front end of the puncture needle **65**. When the operator further applies a force against the pulling force, the puncture needle **65** can be separated from the puncture needle cap **91** (**FIG. 9**(*c*)).

[**0107**] Thereafter, the puncture needle set lever **68** is tilted at a predetermined angle in the direction of arrow A to carry out puncture, whereby preparation for puncture is made (**FIG. 10**(*a*)). Hereinafter, a description will be given of the preparation operation and the puncture operation with reference to FIGS. **10**(*a*)-**10**(*c*).

[**0108**] Initially, the puncture depth adjustment ring **81** provided at the front end of the lancet **61** is rotated about its axis to shift the position of the puncture depth adjustment ring **81** in the axis direction of the lancet **61**, whereby a predetermined puncture depth of the puncture needle **65** is set.

[**0109**] Then, as shown in **FIG. 9**, the puncture needle **65** is loaded in the slider **64**, and thereafter, the puncture needle set lever **68** is tilted at a predetermined angle in the direction of arrow A as shown in **FIG. 10**(*a*), whereby the wheel rotation lever **68***a* that is located in the opposite position from the puncture needle set lever **68** simultaneously rotates counterclockwise with respect to the rotation center **68***b* of the puncture needle set lever **68**. Since the wheel rotation lever **68***a* rotates counterclockwise, the rotation lever **68***a* contacts the set pin **72** on the flywheel **71**, and rotates the set pin **72**, whereby the flywheel **71** rotates by a predetermined angle.

[**0110**] In the state where the puncture needle set lever **68** is tilted at a predetermined angle in the direction of arrow A, by setting the distance between the rotation center **68***b* of the puncture needle set lever **68** and the center axis of the set pin **72** longer than the distance between the rotation center **68***b* of the puncture needle set lever **68** and the rotation center **71***b* of the flywheel **71**, the wheel rotation member (rotation lever) **68***a* on the puncture needle set lever **68** can rotate the flywheel **71** in the setting direction (direction of arrow B in **FIG. 10**(*a*)).

[**0111**] Further, as shown in **FIG. 10**(*a*), in the position where the flywheel **71** is rotated by the predetermined angle, the wheel engagement pin **76** provided on the flywheel **71** is maintained in the state where it is continuously pressed by the flywheel set spring **73**, and therefore, the flywheel **71** tries to keep on rotating in the direction of arrow B in **FIG. 10**(*a*) (counterclockwise), and the flywheel **71** starts to rotate spontaneously by only the pressing force from the flywheel set spring **73**, in a predetermined rotation position, i.e., in a rotation position after the distance between the center of the wheel engagement pin **76** and the rotation center **68***b* of the puncture needle set lever **68** becomes longer than the rotation shaft **71***b* of the flywheel **71** and the rotation center **68***b* of the puncture needle set lever **68**. When the end of the wheel engagement pin **76** of the rotating flywheel **71** contacts the end of the stopper claw **77***a* positioned at the end of the stopper arm **77**, the rotation of the flywheel **71** is stopped.

[**0112**] As described above, with the rotation of the flywheel **71**, the slider **64** that is coupled to the flywheel **71** via the link **79** is slid in the axis direction of the lancet **61** by the link **79** that converts the rotation of the flywheel **71** into sliding of the slider **64**. The wheel engagement pin **76** on the flywheel **71** and the slider **64** are engaged by the single link **79**, and the flywheel **71** is rotated only in the predetermined direction (counterclockwise) as described above by the puncture needle set lever **68**. Therefore, the wheel engagement pin **76** initially rotates ill the direction of going away from the front end of the lancet **61**, and the slider **64** sinks into the body of the lancet **61**. Thereafter, as described above, the end of the wheel engagement pin **76** of the flywheel **71** is engaged with the stopper claw **77***a* which is provided at the end of the rotatably supported stopper arm **77**, whereby the rotation of the flywheel **71** is stopped, and simultaneously, the motion of the slider **64** is stopped. At this time, the axis center of the wheel engagement pin **76** is positioned on the slider side with respect to the rotation center of the flywheel **71**, and the flywheel **71** conserves the rotation power by the force of the flywheel set spring **73**, and thus setting is completed (**FIG. 10**(*a*)). In this way, the wheel engagement pin **76** is constituted as an engagement mechanism for preparation for puncture operation, which fixes the slider to a start position of one reciprocating operation of the slider in its axis direction.

[**0113**] Thereafter, when the stopper arm button **77***c* is pressed, the stopper arm **77** rotates about the shaft **77***b*, and the engagement of the stopper claw **77***a* ad the wheel engagement pin **76** is released, whereby the flywheel **71** rotates at a stroke in the direction of arrow B (counterclockwise) about the shaft **71***b*. At this time, the slider **64** that is coupled to the flywheel **71** by the link **79** starts sliding (linear motion) from the inside of the lancet **61** toward the outside. Thereafter, with the rotation of the flywheel **71**, the

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slider **64** protrudes at maximum from the lancet **61** (**FIG. 10**(*b*)), and then it returns into the lancet **61** by the pressing force of the flywheel set spring **73** and the inertial force of the flywheel **71**. Further, at this time, the puncture needle set lever **68** returns to the initial position by the rotation force of the engaged set pin **72** and the force applied by the lever return spring **74**. Even when the puncture needle set lever **68** is not provided with the lever return spring **74**, the puncture needle set lever **68** can be returned to the initial position by the rotation force of the set pin **72**. However, provision of the lever return spring **74** reduces the load on the rotation of the flywheel **71** during the puncture operation.

[**0114**] During the return operation, the wheel engagement pin **76** at the end of the link **79** reaches a position that is most distant from a line connecting the rotation center **68***b* of the puncture needle set lever **68** and the rotation center **71***b* of the flywheel **71**, and the wheel engagement pin **76** attenuates while reciprocating with the position in the center by the recovery force of the flywheel set spring **73** until it stops in the position, and finally, it stops. At this time, it is necessary to prevent the slider **64** from returning back to the direction in which the slider **64** protrudes from the lancet **61**. For this purpose, the body bottom case **63** is provided with an anti-reverse-rotation mechanism **80** that is engaged with the wheel engagement pin **76** so as not to return the operation of the wheel engagement pin **76** back into the puncture position direction, thereby to prevent reverse rotation of the flywheel after the puncture operation. Moreover, in order to prevent an anti-reverse-rotation claw provided at an end of the anti-reverse-rotation mechanism **80** from becoming a load onto the rotation of the flywheel **71**, an angle of attack is provided at then end of the anti-reverse-rotation claw **80***a* (**FIG. 10**(*c*)).

[**0115**] When the flywheel **71** rotates to a predetermined position, the wheel engagement pin **76** contacts the anti-reverse-rotation claw **80***a* at the end of the flexible anti-reverse-rotation mechanism **80**. When the flywheel **71** continues to rotate, the wheel engagement pin **76** gets on the upper surface of the anti-reverse-rotation claw **80***a,* and slides while bending and pushing down the anti-reverse-rotation mechanism **80** to the lower left in the figure. At the instant when the wheel engagement ping **76** passes over the upper surface, the anti-reverse-rotation claw **80***a* returns to the initial state, and catches the wheel engagement pin **76**. That is, since the anti-reverse-rotation claw **80***a* is provided with the above-mentioned angle of attack, the wheel engagement pin **76** can smoothly get on the upper surface of the anti-reverse-rotation claw **80***a* at a preferable angle and pass the claw **80***a* so that it docs not become load on the rotation of the flywheel **71**. Thus, the lancet can prevent reverse rotation of the flywheel **71** without applying load on the rotation of the wheel engagement pin **76** (**FIG. 10**(*c*)).

[**0116**] Next, a description will be given of the operation of discarding the puncture needle **65** after the puncture operation has been completed.

[**0117**] In the state where the above-mentioned puncture operation has been completed, the puncture depth adjustment ring **81** on the puncture needle loading slot **69** side of the lancet **61** is removed, the front end of the puncture needle **65** is exposed (**FIG. 11**(*a*)). In this state, the shaft of the disposal slot **92**, which is provided at an end of the puncture needle cap **91** the other end of which has covered the front end of the puncture needle **65** before used, is fitted to the front end of the puncture needle **65**, and the front end of the puncture needle **65** is pressed into the disposal slot **92** to snugly insert the needle **65** into the slot **92**, whereby the puncture needle **65** is captured into the disposal slot **92** (**FIG. 11**(*b*)). Thereafter, the puncture needle cap **91** having the puncture needle **65** is pulled out of the lancet **61**, whereby discarding of the used puncture needle **65** is completed (**FIG. 11**(*c*)), and the puncture needle **65** can be discarded safely and easily without exposing the front end of the puncture needle.

[**0118**] Accordingly, it is possible for an operator to easily perform puncture during measurement of blood sugar or the like, by repeating a series of operations as described above. That is, the operator can complete setting of a puncture needle by rotating the puncture needle set lever **68**, and perform puncture and blood collection as shown in **FIG. 12** by pressing the stopper arm **77** in the puncture-ready state.

[**0119**] As described above, the lancet for blood collection according to the second embodiment is provided with the slider **64** that is able to hold the puncture needle **65** at an end thereof, and is reversibly slidable in a linear direction; the flywheel **71** that is rotated while being supported by the wheel rotation shaft **71***b;* the link **79** having an end engaged with the other end of the slider **64**, and the other end engaged with the wheel engagement pin **76** that is implanted in the flywheel **71** as its rotation knot shaft, thereby to convert the rotation of the flywheel **71** into sliding of the slider **64**; the flywheel set spring **73** for applying a force to the flywheel **71** to rotate the flywheel **71** in a constant direction; the set lever **68** for setting the flywheel **71** in a puncture-ready state by rotating the flywheel **71** only in one direction with the set pin **72** implanted in the flywheel **71** being engaged with the set lever **68**; the stopper art **77** that has an end contacting the wheel engagement pin **76**, and is externally operable; and the anti-reverse-rotation mechanism **80** that is provided on the body case, and stops the wheel engagement pin **76** The flywheel set spring **73** applies a force to the wheel engagement pin **76** to rotate the flywheel **71** about its rotation axis only in one direction. Therefore, it is possible to reliably rotate the flywheel **71** to make the puncture needle protrude from the lancet body for puncture operation, and back off the puncture needle immediately after the puncture operation, with the simple construction. Further, the anti-reverse-rotation mechanism **80** prevents the puncture needle from protruding from the lancet body again due to vibration of the flywheel set spring **73** after the puncture needle is backed off into the lancet body. Thereby, vibration or impulsive sound of the lancet body during puncture can be avoided to reduce pain and unconformity of the patient during puncture.

[**0120**] While the lancet **61** according to the second embodiment is provided with the puncture depth adjustment ring **81** that is united with the puncture needle loading slot **69**, the lancet **1** may dispense with the puncture depth adjustment ring **81** as shown in **FIG. 1**. In this case, the front end of the lancet is shaped so that setting and discarding of the puncture needle can be carried out, whereby it becomes unnecessary to disconnect the puncture depth adjustment ring **81** during discarding of the puncture needle, and the discarding operation can be safely carried out. Conversely, it is possible to provide a puncture depth adjustment ring **81** at the front end of the lancet **1** according to the first embodiment.

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[0121] Further, while in the lancet according to the second embodiment, the anti-reverse-rotation mechanism **80** is integrally arranged with the body case, the present invention is not restricted thereto. Any mechanism may be employed so long as it can prevent reverse rotation of the flywheel **71**, for example, the ratchet **7** shown in **FIG. 1** may be employed.

[0122] Furthermore, as in the first embodiment, the puncture needle **65** may be provided with a protrusion **4***b* and a rotation stop rib **4***d* as shown in **FIG. 3**(*a*). In this case, the puncture needle cap **91** and the puncture needle fixing hole **70** are shaped so as to be fitted to the protrusion and the rotation stop rib. Further, the puncture needle fixing hole **70** may be provided with a catch claw **3***d* as shown in **FIG. 3**(*c*). Thereby, setting of the puncture needle is facilitated.

[0123] Furthermore, as in the first embodiment, the puncture needle **65** may be provided with a safety claw **4***f* as shown in **FIG. 1** At this time, a puncture needle stopper **2***f* as shown in **FIG. 1** may be provided in the puncture needle loading slot, whereby the puncture needle is prevented from dropping. Further, at this time, the puncture needle cap **91** is shaped so as to be fitted to the safety claw, whereby it can function as the above-mentioned rotation stop rib.

[0124] According to the present invention, it is possible to provide a lancet and a puncture needle unit, which reduce shock, sound, and vibration during puncture, prevent plural times of puncture by a puncture needle, reduce pain and fear of a patient, and are easy to handle and highly reliable. Therefore, the lancet and the puncture needle unit are useful for performing measurement that requires blood collection.

1. A lancet for puncturing a human body with a puncture needle to collect bodily fluids from the human body, comprising:

a slider which is able to hold a puncture needle at one end, and is reversibly slidable in a linear direction so that a puncture operation by the puncture needle is carried out;

a cam ring which is flat-shaped and rotatable about its axis, has a cam groove that is engaged with a cam follower provided on the slider within its rotation plane, and slides the slider by its rotation operation;

an elastic force application member for applying a rotation force in a predetermined direction to the cam ring to slide the slider in a puncture direction;

a stopper arm for stopping the rotation of the cam ring to which a force is applied by the elastic force application member, or releasing the stopping; and

an anti-reverse-rotation mechanism which is implemented by a ratchet mechanism for preventing reverse rotation of the cam ring after the puncture operation.

2. A lancet as defined in claim 1 wherein

said anti-reverse-rotation mechanism releases the stopping of rotation of the cam ring to which a force is applied by the elastic force application member, by the releasing operation of the stopper arm; and

when the slider moves with the rotation of the cam ring and thereby a puncture operation is carried out and then the slider moves in a direction that goes apart from the puncture direction with further rotation of the cam ring, the anti-reverse-rotation mechanism restricts the rotation of the cam ring in one direction so as to prevent the slider from moving in the puncture direction again.

3. A lancet as defined in claim 1 wherein

said stopper arm has a stopper claw that contacts a cam ring claw of the cam ring, in a puncture-ready position where the puncture needle is backed off into the lancet, and a rotation force applied to the cam ring by the elastic force application member is active;

when the stopper arm is pressed and rotated in the above-mentioned state, the contact of the stopper claw of the stopper arm and the cam ring claw is released, whereby the cam ring rotates in a predetermined position; and

when the slider slides in the puncture direction by the rotation of the cam ring and thereby the cam ring rotates exceeding a maximum protrusion position of the puncture needle, an anti-reverse claw of the cam ring passes over a ratchet claw of the ratchet mechanism while bending the ratchet mechanism, and catches the ratchet claw to prevent the cam ring from rotating in the opposite direction.

4. A lancet as defined in claim 1 wherein

said stopper arm has a stopper for restricting the amount of rotation of the stopper arm toward the cam ring; and

said ratchet has a stopper for restricting the amount of rotation of the ratchet toward the cam ring.

5. A lancet as defined in claim 1 further comprising:

a set ring which is rotatably provided on the same axis as the cam ring; and

a force transfer mechanism for transferring a rotation force of the set ring only in one direction;

wherein the rotation force of the set ring is transferred to the cam ring through the force transferring mechanism.

6. A lancet of claim 1 wherein

said elastic force application member is implemented by a ring spring.

7. A lancet for puncturing a human body with a puncture needle to collect bodily fluids from the human body, comprising:

a slider which is able to hold a puncture needle at one end, and is reversibly slidable in a linear direction so that a puncture operation by the puncture needle is carried out;

a link mechanism which is coupled to the other end of the slider;

a flywheel which is mounted rotatably with respect to the link mechanism, and is coupled to the link mechanism by implanting a rotation knot shaft as a shaft on the other end of the link mechanism coupled to the slider, in the flywheel;

an elastic force application member for applying a rotation force in a predetermined direction to the flywheel to slide the slider in a puncture direction through the link mechanism;

a stopper arm for stopping the rotation of the flywheel to which a force is applied by the elastic force application member, or releasing the stopping;

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a set lever mechanism which is engaged with a wheel set pin provided on the flywheel, and rotates the flywheel only in one direction, thereby setting the slider in a puncture-ready position; and

an anti-reverse-rotation mechanism which prevents reverse rotation of the flywheel after the puncture operation.

8. A lancet as defined in claim 7 wherein

said anti-reverse-rotation mechanism releases the stopping of rotation of the flywheel to which a force is applied by the elastic force application member, by the releasing operation of the stopper arm; and

when the slider moves with the rotation of the flywheel and thereby a puncture operation is carried out and then the slider moves in a direction that goes apart from the puncture direction with further rotation of the flywheel, the anti-reverse-rotation mechanism restricts the rotation of the flywheel in one direction so as to prevent the slider from moving in the puncture direction again.

9. A lancet as defined in claim 7 wherein

said stopper arm has a stopper claw that contacts the rotation knot shaft implanted in the flywheel, in a puncture-ready position where the puncture needle is backed off into the lancet, and a rotation force applied to the flywheel by the elastic force application member is active;

when the stopper arm is pressed and rotated in the above-mentioned state, the contact of the stopper claw of the stopper arm and the rotation knot shaft is released, whereby the flywheel rotates in a predetermined position; and

when the slider slides in the puncture direction by the rotation of the flywheel through the link mechanism and thereby the flywheel rotates exceeding a maximum protrusion position of the puncture needle, the rotation knot shaft passes over an anti-reverse-rotation claw of the anti-reverse-rotation mechanism while bending the anti-reverse-rotation mechanism, and catches the anti-reverse-rotation claw to prevent the flywheel from rotating in the opposite direction.

10. A lancet as defined in claim 7 wherein

said set lever mechanism is provided with an elastic member for returning the set lever mechanism back to the initial state when the contact of the front end of the stopper arm with the rotation knot shaft is released.

11. A lancet as defined in claim 7 wherein

said rotation knot shaft is constituted as a catch mechanism for puncture preparation in which the slider is fixed to a start position of one reciprocating operation of the slider in its axis direction, by being engaged with the front end of the stopper arm.

12. A lancet as defined in claim 11 wherein

said elastic force application member applies a force to the rotation knot shaft so as to rotate the flywheel around its axis in a predetermined rotation direction.

13. A lancet as defined in claim 11 wherein

said elastic force application member for applying a force to the rotation knot shaft is implemented by a kick spring.

14. A lancet as defined in claim 11 wherein

in the puncture-ready state, the center of the rotation knot shaft is located on the slider side with respect to the rotation center of the flywheel.

15. A lancet as defined in claim 1 wherein

said puncture needle has a safety claw which is engaged with the inner surface of an external case of the lancet to prevent the puncture needle from dropping when the puncture needle is detached from the lancet.

16. A lancet as defined in claim 1 wherein

said slider has a fitting and fixing hole for fixing the puncture needle; and

said puncture needle is a puncture needle unit comprising a puncture needle body and a puncture needle cap, and the puncture needle body has

a puncture needle main part having a needle at its front end,

a protrusion to be fitted and fixed to the fitting and fixing hole, at an external surface of a base portion of the puncture needle main part, and

a rotation stop rib for the puncture needle cap that covers the puncture needle body, at a side surface of an upper portion of the puncture needle body, and

the puncture needle cap is fitted to the rotation stop rib and is lightly pressed into the puncture needle body to cover the puncture needle body.

17. A lancet as defined in claim 16 wherein

in said puncture needle unit, the puncture needle main part is snugly fitted and attached to the lancet with the puncture needle cap being attached to the puncture needle body part; and

after the puncture needle main part is attached to the lancet, the puncture needle cap is removed from the puncture needle main part.

18. A lancet as defined in claim 16 wherein

said puncture needle unit detaches the puncture needle main part from the lancet as follows:

the puncture needle cap is pressed in and snugly fitted to the puncture needle main part after performing the puncture operation; and

the puncture needle main part is removed together with the puncture needle cap from the lancet body together.

19. A lancet as defined in claim 16 wherein

said puncture needle cap is cylindrical in shape, and has protection slots for protecting the puncture needle after performing the puncture operation from the lancet body, which slots are formed from both of an end and the other end of the cylindrical shape.

20. A lancet as defined in claim 16 wherein

said puncture needle cap is cylindrical in shape, and has a protection slot for protecting the puncture needle, which is formed from an end of the cylindrical shape, and a disposal slot for taking the puncture needle after performing the puncture operation from the lancet body and discarding the needle, which is formed from the other end of the cylindrical shape, and fitting of the

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puncture needle to the disposal slot is easier than fitting of the puncture needle to the protection slot.

21. A lancet as defined in claim 20 wherein

said disposal slot of the puncture needle cap has an opening that is larger than an opening of the protection slot.

22. A lancet as defined in claim 16 wherein

said puncture needle body has a safety claw which is engaged with the inner surface of an external case of the lancet to prevent the puncture needle from dropping when the puncture needle body is detached from the lancet; and

said puncture needle cap is lightly pressed into the puncture needle body while being fitted to the safety claw, to cover the puncture needle body.

23. A puncture needle unit comprising:

a puncture needle body, and a puncture needle cap, said puncture needle body having

a puncture needle main part having a needle at its front end,

a protrusion to be fitted and fixed to a fitting and fixing hole provided on the lancet body, which protrusion is provided on an external surface of a base portion of the puncture needle main part, and

a rotation stop rib for the puncture needle cap that covers the puncture needle body, which rib is provided on a side surface of an upper portion of the puncture needle body; and

said puncture needle cap being fitted to the rotation stop rib and lightly pressed into the puncture needle body to cover the puncture needle body.

24. A puncture needle unit as defined in claim 23 wherein

said puncture needle body has a safety claw that is engaged with the inner surface of an external, case of the lancet to prevent the puncture needle from dropping when the puncture needle is detached from the lancet; and

said puncture needle cap is lightly pressed into the puncture needle body while being fitted to the safety claw, to cover the puncture needle body.

25. A lancet as defined in claim 7 wherein

said puncture needle has a safety claw which is engaged with the inner surface of an external case of the lancet to prevent the puncture needle from dropping when the puncture needle is detached from the lancet.

26. A lancet as defined in claim 7 wherein

said slider has a fitting and fixing hole for fixing the puncture needle; and

said puncture needle is a puncture needle unit comprising a puncture needle body and a puncture needle cap, and the puncture needle body has

a puncture needle main part having a needle at its front end,

a protrusion to be fitted and fixed to the fitting and fixing hole, at an external surface of a base portion of the puncture needle main part, and

a rotation stop rib for the puncture needle cap that covers the puncture needle body, at a side surface of an upper portion of the puncture needle body, and

the puncture needle cap is fitted to the rotation stop rib and is lightly pressed into the puncture needle body to cover the puncture needle body.

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