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(71) Applicant: **MITSUBISHI PENCIL COMPANY, LIMITED**
Tokyo 140-8537 (JP)

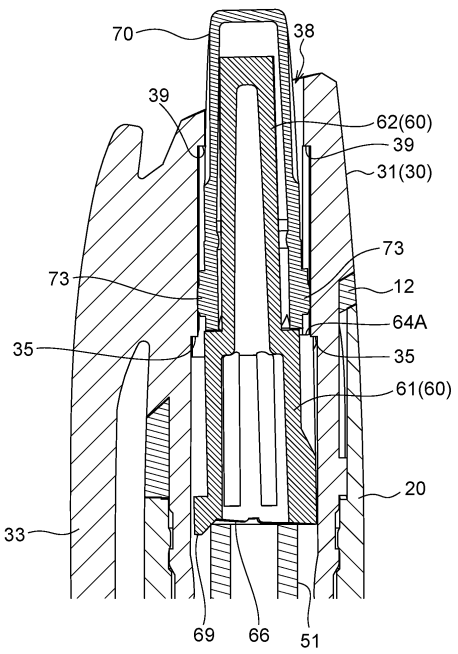
(72) Inventors:
- **YANAGI, Hisanori**
  Tokyo 140-8537 (JP)
- **YAMADA, Masaya**
  Tokyo 140-8537 (JP)

(74) Representative: **Vossius & Partner Patentanwälte Rechtsanwälte mbB**
Siebertstraße 3
81675 München (DE)

(54) BALLPOINT PEN

(57) A ballpoint pen includes a knock spring interposed between a shaft tube and a refill, a rotor having a cam formed on a rear end surface of the rotor and a pressing rod protruding toward a rear side, a knock button configured for the pressing rod to be inserted into an internal space thereof, an inner peripheral cam formed on an inner surface near a rear end of the shaft tube, a plurality of engagement cams formed on the rear end surface of the rotor and engaged with the inner peripheral cam, and an inclined surface that is a front end surface of the rotor and is inclined rearwards, in which the ballpoint pen is formed such that, in a state in which the rotor is pressed by the knock button and the engagement cams are engaged with the inner peripheral cam, the refill is biased rearwards by the knock spring, the inclined surface is pressed rearwards by the rear end of the refill such that the rotor is inclined toward a position of the inclined surface, the position being closest to a rear side with respect to an axial center, and the pressing rod presses an inner peripheral surface of the knock button so as to fix the knock button to the shaft tube.

FIG.12



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Description

Technical Field

[0001] The present disclosure relates to a retractable ballpoint pen.

Background Art

[0002] As for a so-called retractable ballpoint pen in which a front end of a built-in refill is taken in and out from a front end of a shaft tube by pressing a knock button protruding from a rear end of the shaft tube, techniques described in Japanese Patent Application Laid-Open (JP-A) No. 2023-70970, Japanese Patent Application Laid-Open (JP-A) No. 2009-34879, Japanese Patent Application Laid-Open (JP-A) No. 2015-3443, Japanese Patent Application Laid-Open (JP-A) No. 2016-37011, and Japanese Patent Application Laid-Open (JP-A) No. 2016-107615 are disclosed.

[0003] In this prior art, a cam is formed on a rotor that is pressed by a knock button. The knock button and the rotor are biased rearwards by a knock spring housed in a shaft tube. In a case in which the knock button is pressed against biasing force of a knock rod, the rotor is moved forwards, and the cam of the rotor is engaged with a cam formed on the inner periphery of the shaft tube. At this time, the knock spring biases the rotor rearwards, thereby maintaining this engagement state. In this state, a front end of a refill protrudes from a front end of the shaft tube to maintain a writing state.

[0004] In a case in which the knock button is pressed again from this state, the engagement between the cam of the rotor and the cam of the shaft tube is released. The rotor biased rearwards by the knock spring is then moved rearwards. Accordingly, the front end of the refill is retracted into the shaft tube.

SUMMARY OF INVENTION

Problem to be Solved by the Invention

[0005] In a retractable ballpoint pen, in a writing state in which a knock button is pressed, the knock button and a rotor are not physically engaged with each other, and the knock button is usually free. Therefore, the knock button may also vibrate along with vibration at the time of writing. An object of the ballpoint pen of the present disclosure is to prevent vibration of a pressed knock button during writing.

Means for Solving the Problem

(1) First Aspect

[0006] A ballpoint pen according to a first aspect of the present disclosure includes: a shaft tube; a refill accommodated in the shaft tube, the refill having a front end protruding and retracting from the shaft tube in conjunction with a knock operation; a knock spring interposed between the shaft tube and the refill, the knock spring biasing the refill rearwards; a rotor including a cam portion having a cam formed on a rear end surface of the rotor, the cam portion having a substantially cylindrical shape, and a pressing rod protruding rearwards from the cam portion, the pressing rod having a rod-like shape with a smaller diameter than a diameter of the cam portion, the rotor abutting a rear end of the refill; a knock button having an internal space into which the pressing rod is inserted so as to abut the knock button, the knock button abutting a rear end of the cam portion and partially protruding from a rear end of the shaft tube; an inner peripheral cam formed on an inner surface near the rear end of the shaft tube; a knock cam formed on a front end surface of the knock button; a rotation cam formed on the rear end surface of the rotor, the rotation cam meshing with the knock cam; plural engagement cams formed on an outer peripheral side of the rotation cam, the engagement cams meshing with the inner peripheral cam; and an inclined surface that is a front end surface of the rotor and that is inclined rearwards.

[0007] The ballpoint pen according to the embodiment of the present disclosure is further formed such that, in a state in which the rotor is pressed by the knock button and the engagements cams are engaged with the inner peripheral cam, the refill is biased rearwards by the knock spring, the inclined surface is pressed rearwards by the rear end of the refill such that the rotor is inclined toward a position of the inclined surface, the position being closest to a rear side with respect to an axial center, and the pressing rod presses an inner peripheral surface of the knock button so as to fix the knock button to the shaft tube.

[0008] In a case in which the knock button is pressed against biasing force of the knock spring, the knock button presses the rotor forwards in a state in which the knock cam of the knock button meshes with the rotation cam of the rotor. As the rotor is pressed forwards, the rotor presses the refill forwards. The engagement cams of the rotor are then engaged with the inner peripheral cam of the shaft tube, whereby the state in which the front end of the refill protrudes from the shaft tube is maintained, and the writing state is obtained.

[0009] In this state, the refill is biased rearwards by the knock spring. The rear end of the refill abuts and presses the inclined surface of the rotor. As a result, the rotor is inclined toward a side of the inclined surface, which is closest to the rear side with respect to the axial center. Due to the inclination of the rotor, the pressing rod presses the inner peripheral surface of the knock button, and presses the knock button to the pressed side. The knock button is sandwiched between the pressing rod and the inner peripheral surface of the shaft tube to suppress movement. Accordingly, it is possible to prevent vibration of the knock button during writing.

(2) Second Aspect

[0010] In a ballpoint pen according to a second aspect of the present disclosure, in addition to the configuration of the first aspect, preferably, the plural engagement cams include: an inclined cam engaged with the inner peripheral cam at a position closer to a front side than other cams, the inclined cam being located on a side of the inclined surface, the side being located closest to the front side; and a fulcrum cam facing the inclined cam with the axial center interposed therebetween, the fulcrum cam being engaged with the inner peripheral cam at a position closer to the rear side than the other cams and being located on a side of the inclined surface, the side being located closest to the rear side, and the inclined cam is engaged with the inner peripheral cam such that the rotor is inclined in a direction toward the fulcrum cam.

[0011] As described in the first aspect, in the writing state, the rear end of the refill abuts and presses the inclined surface of the rotor. As a result, the rotor is inclined toward a side of the inclined surface, which is closest to the rear side with respect to the axial center. At this time, among the engagement cams engaged with the inner peripheral cam of the shaft tube, the fulcrum cam located at the rearmost position and the inclined cam located at the foremost position are simultaneously engaged with the inner peripheral cam, so that the rotor is inclined in the direction toward the fulcrum cam.

(3) Third Aspect

[0012] In a ballpoint pen according to a third aspect of the present disclosure, in addition to the configuration of the second aspect, a front protrusion protruding toward the front side is formed on a side of the inclined surface, in which the fulcrum cam is provided.

[0013] As described in the first aspect, in the writing state, the rear end of the refill abuts and presses the inclined surface of the rotor. At this time, the rear end of the refill abuts the front protrusion such that the rear end of the refill easily presses the position of the inclined cam located on the side opposite to the front protrusion rearwards. As a result, the rotor is easily inclined in the direction toward the fulcrum cam.

Advantageous Effects of Invention

[0014] Since the ballpoint pen of the present disclosure is configured as described above, it is possible to prevent vibration of the pressed knock button, at the time of writing, by the pressing of the knock button due to the inclination of the rotor.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

Fig. 1A is a front view of a ballpoint pen of a first embodiment.
Fig. 1B is a side view of the ballpoint pen in Fig. 1A.
Fig. 1C is a cross-sectional view taken along line I-I in Fig. 1A.
Fig. 2A is a front view of an inner barrel used in the ballpoint pen in Fig. 1A.
Fig. 2B is a side view of the inner barrel in Fig. 2A.
Fig. 2C is a plan view of the inner barrel in Fig. 2A.
Fig. 2D is a bottom view of the inner barrel in Fig. 2A.
Fig. 2E is a cross-sectional view taken along line IIa-IIa in Fig. 2A.
Fig. 2F is a cross-sectional view taken along line IIb-IIb in Fig. 2E.
Fig. 3A is a front view of a rotor used in the ballpoint pen in Fig. 1A.
Fig. 3B is a side view of the rotor in Fig. 3A.
Fig. 3C is a front perspective view of the rotor in Fig. 3A.
Fig. 3D is a rear perspective view of the rotor in Fig. 3A.
Fig. 3E is a plan view of the rotor in Fig. 3A.
Fig. 3F is a bottom view of the rotor in Fig. 3A.
Fig. 3G is a cross-sectional view taken along line III-III in Fig. 3A.
Fig. 4A is a front view of a knock button used in the ballpoint pen in Fig. 1A.
Fig. 4B is a side view of the knock button in Fig. 4A.
Fig. 4C is a rear perspective view of the knock button in Fig. 4A.
Fig. 4D is a plan view of the knock button in Fig. 4A.
Fig. 4E is a bottom view of the knock button in Fig. 4A.
Fig. 4F is a cross-sectional view taken along line IV-IV in Fig. 4A.
Fig. 5 is an enlarged view of a rear end portion in Fig. 1C.
Fig. 6A is a front view of the ballpoint pen in a writing state.
Fig. 6B is a perspective view of the ballpoint pen in Fig. 6A.
Fig. 6C is a cross-sectional view taken along line VI-VI in Fig. 6A.
Fig. 7 is an enlarged view of a rear end portion in Fig. 6C.
Fig. 8A is a front view of a ballpoint pen of a second embodiment.
Fig. 8B is a side view of the ballpoint pen in Fig. 8A.
Fig. 8C is a cross-sectional view taken along line VIII-VIII in Fig. 8A.
Fig. 9A is a front view of a rotor used in the ballpoint pen in Fig. 8A.
Fig. 9B is a side view of the rotor in Fig. 9A.
Fig. 9C is a rear perspective view of the rotor in Fig. 9A.
Fig. 9D is a front perspective view of the rotor in Fig. 9A.
Fig. 9E is a plan view of the rotor in Fig. 9A.
Fig. 9F is a bottom view of the rotor in Fig. 9A.
Fig. 9G is a cross-sectional view taken along line IX-

IX in Fig. 9A.
Fig. 10 is an enlarged view of a rear end portion in Fig. 8C.
Fig. 11A is a front view of the ballpoint pen in Fig. 8A in a state in which a knock button is pressed.
Fig. 11B is a side view of the ballpoint pen in Fig. 11A.
Fig. 11C is a cross-sectional view taken along line XI-XI in Fig. 11A.
Fig. 12 is an enlarged view of a rear end portion in Fig. 11C.

DESCRIPTION OF EMBODIMENTS

[0016] Hereinafter, embodiments of the present disclosure will be described with reference to the drawings. Reference numerals commonly assigned in each drawing refer to common components or members even in a case in which the reference numerals are not mentioned in the description of each drawing. In the following description, in a ballpoint pen, a side on which a ballpoint pen tip is located is referred to as a "front end", and the opposite side, that is, a side on which a knock button is located is referred to as a "rear end". Further, at any position in the ballpoint pen, a direction of the front end is referred to as "front", and a direction of the rear end is referred to as "rear".

(1) First Embodiment

(1-1) Overall Configuration of Ballpoint Pen 10

[0017] An overall configuration of a ballpoint pen 10 of a first embodiment will be described with reference to Figs. 1A to 1C. Fig. 1A is a front view of the ballpoint pen 10, Fig. 1B is a side view of the ballpoint pen 10 in Fig. 1A, and Fig. 1C is a cross-sectional view taken along line I-I in Fig. 1A. Figs. 1A to 1C illustrate the ballpoint pen 10 in a non-writing state.

[0018] The ballpoint pen 10 of the present embodiment has an appearance in which a knock button 70 protrudes from the rear end of a shaft tube 15 provided with a clip 33. The shaft tube 15 is a substantially cylindrical member and includes an outer barrel 20 that accommodates a refill 50 (Fig. 1C), an inner barrel 30 attached to the rear end of the outer barrel 20, and a front barrel 40 attached to the front end of the outer barrel 20. The outer barrel 20, the inner barrel 30, and the front barrel are each formed of a hard resin. A grip 21 made of an elastic resin material such as elastomer is attached to an outer peripheral surface on the front end side of outer barrel 20. The front end of the outer barrel 20 is a male screw portion 22 (Fig. 1C) formed in such a way that the outer diameter is reduced and the outer peripheral surface is threaded.

[0019] The front barrel 40 includes a large-diameter portion 41 located on the rear side and formed to have a relatively large outer diameter, and a tapered portion 43 located on the front side and formed to have an outer diameter gradually decreasing in a direction toward the front end. An inner peripheral surface of the large-diameter portion 41 becomes a female screw portion 42 having a threaded portion (Fig. 1C). A front end opening 46 through which a ballpoint pen tip 53 (Fig. 1C) protrudes and retracts is provided in the front end of the front barrel 40. The female screw portion 42 is screwed to the male screw portion 22 such that the front barrel 40 is attached to the outer barrel 20. As illustrated in Fig. 1C, the inner barrel 30 includes an exposed portion 31 exposed to the outside, an insertion portion 32 inserted into the outer barrel 20, and a clip 33 formed on the front side of the exposed portion 31 and formed to extend forwards. A packing 12 made of an elastic resin material is interposed between the exposed portion 31 of the inner barrel 30 and the rear end of the outer periphery of the outer barrel 20. Details of the structure of the inner barrel 30 will be described later.

[0020] As illustrated in Fig. 1C, the refill 50 is accommodated in the shaft tube 15. The refill 50 includes a relatively soft resin tubular ink accommodation tube 51, a joint 52 attached to the front end of the ink accommodation tube 51, and the ballpoint pen tip 53 attached to the front end of the joint 52. The ink accommodation tube 51 accommodates ink 51A, and further accommodates a follower 51B on the rear side of the ink 51A. The ballpoint pen tip 53 has a structure in which a metallic writing ball 53B is held at the front end of a metallic holder 53A having a substantially cylindrical shape. The joint 52 is a member that connects the ink accommodation tube 51 to the ballpoint pen tip 53, and includes a rear connection portion 52A having a relatively large diameter and into which the front end of the ink accommodation tube 51 is press-fitted, and a front connection portion 52B having a relatively small diameter and into which the rear end of the ballpoint pen tip 53 is press-fitted.

[0021] As illustrated in Fig. 1C, a rotor 60 is mounted inside the exposed portion 31 of the inner barrel 30. The front end of the rotor 60 abuts the rear end of the refill 50. A rear end portion of the rotor 60 is inserted into an internal space of the knock button 70 and is in contact therewith. Details of the structures of the rotor 60 and the knock button 70 will be described later.

[0022] As illustrated in Fig. 1C, a knock spring 11 is interposed between a step between the rear connection portion 52A and the front connection portion 52B of the joint 52 and a step formed inside the tapered portion 43 of the front barrel 40. The refill 50, the rotor 60, and the knock button 70 are constantly biased rearwards by the knock spring 11.

(1-2) Inner Barrel 30

[0023] The structure of the inner barrel 30 used in the ballpoint pen 10 of the present embodiment will be described with reference to Figs. 2A to 2F. Fig. 2A is a front view of the inner barrel 30, Fig. 2B is a side view of the inner barrel 30, Fig. 2C is a plan view of the inner barrel 30, Fig. 2D is a bottom view of the inner barrel 30, Fig. 2E

is a cross-sectional view taken along line IIa-IIa in Fig. 2A, and Fig. 2F is a cross-sectional view taken along line IIb-IIb in Fig. 2E.

[0024] The inner barrel 30 includes the exposed portion 31 exposed to the outside, the insertion portion 32 inserted into the outer barrel 20, and the clip 33 formed on the front side of the exposed portion 31 and formed to extend forwards. The exposed portion 31 has a substantially cylindrical shape, the outer shape of which is slightly reduced in diameter in a direction toward the rear side. The front end side of the exposed portion 31 is inclined such that the front surface side becomes long and the back surface side becomes short in accordance with the shape (refer to Fig. 1B) of the rear end side of the outer barrel 20 to be attached (Fig. 2B). The rear end surface of the exposed portion 31 is also inclined in the same manner. Further, a rear end opening 38 through which the knock button 70 (Figs. 1A to 1C) passes is formed at the rear end of the exposed portion 31 (Fig. 2A, Fig. 2C, and Fig. 2E). The insertion portion 32 is formed in a substantially cylindrical shape having a smaller diameter than that of the exposed portion 31. The front end of the insertion portion 32 has a shape obliquely scraped in accordance with the inclination of the front end side of the exposed portion 31.

[0025] As illustrated in Figs. 2E and 2F, eight guide protrusions 34 extending in the axial direction are equally disposed on the inner peripheral surface of the exposed portion 31. Four relatively deep first guide grooves 36 and four relatively shallow second guide grooves 37 are alternately and equally disposed between the guide protrusions 34 (Fig. 2F). An inner peripheral cam 35 with which engagement cams 64 (Fig. 3A) of the rotor 60 to be described later are engaged is formed at the front end of each guide protrusion 34 (Figs. 2D and 2E). In addition, since the inner diameter is slightly reduced in the vicinity of the rear end of the inner peripheral surface of the inner barrel 30, a rear end step 39 is formed (Fig. 2E).

(1-3) Rotor 60

[0026] The structure of the rotor 60 used in the ballpoint pen 10 of the present embodiment will be described with reference to Figs. 3A to 3G. Fig. 3A is a front view of the rotor 60, Fig. 3B is a side view of the rotor 60, Fig. 3C is a front perspective view of the rotor 60, Fig. 3D is a rear perspective view of the rotor 60, Fig. 3E is a plan view of the rotor 60, Fig. 3F is a bottom view of the rotor 60, and Fig. 3G is a cross-sectional view taken along line III-III in Fig. 3A.

[0027] The rotor 60 includes a cam portion 61 that is formed in a substantially cylindrical shape and has a cam formed thereon, and a columnar pressing rod 62 that has a smaller diameter than that of the cam portion 61 and protrudes toward the front end. A serrated rotation cam 63 in which eight ridges and eight valleys are alternately equally arranged is formed on the front end surface of the cam portion 61 (Fig. 3D). On the other hand, the rear end edge of the cam portion 61 is a flange 68 having an increased outer diameter. Four inner peripheral ribs 65 extending in the axial direction are equally arranged on the inner peripheral surface of the cam portion 61 (Fig. 3C, Fig. 3F, and Fig. 3G).

[0028] Four sliding protrusions 67 extending in the axial direction are equally arranged on the outer peripheral surface of the cam portion 61. An engagement cam 64 as an inclined surface, the height of which increases from the right side to the left side when viewed from the front, is formed at the front end of the sliding protrusion 67. The sliding protrusion 67 is formed at a position where the inclination of the engagement cam 64 coincides with the inclination of the rotation cam 63 (Fig. 3A, Fig 3B, and Fig. 3D). The outer peripheral surface of the sliding protrusion 67 coincides with the outer peripheral surface of the flange 68 (Figs. 3A to 3D and Fig. 3E). The sliding protrusion 67 fits into the first guide groove 36 (Fig. 2F) of the inner barrel 30 and slides back and forth along the first guide groove 36.

[0029] One of the four engagement cams 64 has a cam surface located closer to the front end side than the others, and this is referred to as an inclined cam 64A (Fig. 3A, Fig. 3B, Fig. 3D, and Fig. 3E). The other one of the four engagement cams 64 has a cam surface located closer to the rear end side than the others, and this is referred to as a fulcrum cam 64B (Fig. 3B, Fig 3D, and Fig. 3E). The cam surface of the fulcrum cam 64B coincides with the cam surface of the rotation cam 63 (Fig. 3B and Fig. 3E). The engagement cam 64 other than the fulcrum cam 64B and the cam surface of the engagement cam 64 are located closer to the front end side than the cam surface of the rotation cam 63 (Fig. 3A, Fig. 3B, and Fig. 3D).

[0030] The front end surface of the rotor 60 becomes an inclined surface 66 inclined rearwards (Fig. 3B, Fig. 3C, Fig. 3F, and Fig. 3G). Specifically, the side of the inclined surface 66, located closest to the front side, corresponds to a side on which the inclined cam 64A is located. The side of the inclined surface 66, located closest to the rear side, corresponds to a side on which the fulcrum cam 64B is located (Fig. 3B and Fig. 3G).

(1-4) Knock Button

[0031] The structure of the knock button 70 used in the ballpoint pen 10 of the present embodiment will be described with reference to Figs. 4A to 4F. Fig. 4A is a front view of the knock button 70, Fig. 4B is a side view of the knock button 70, Fig. 4C is a rear perspective view of the knock button 70, Fig. 4D is a plan view of the knock button 70, Fig. 4E is a bottom view of the knock button 70, and Fig. 4F is a cross-sectional view taken along line IV-IV in Fig. 4A.

[0032] The knock button 70 includes a cam cylindrical portion 71 that is located on the front side and has a substantially cylindrical shape, and a protruding portion 72 that is located on the rear side and has a substantially

cylindrical shape with a slightly tapered rear side. The cam cylindrical portion 71 is a portion that slides back and forth inside the exposed portion 31 (Fig. 2E) of the inner barrel 30. The protruding portion 72 is a portion protruding from the rear end of the shaft tube 15 in the non-writing state (Figs. 1A to 1C). A shallow groove 75 is formed in each of the front surface and the back surface of the protruding portion 72 (Fig. 4A, Fig. 4D, and Fig. 4F).

[0033] A serrated knock cam 74 in which eight ridges and eight valleys are alternately equally arranged is formed on the front end surface of the cam cylindrical portion 71 (Figs. 4A to 4C, Fig. 4E, and Fig. 4F). The knock cam 74 is formed such that the rotation cam 63 (Fig. 3D and Fig. 3E) of the rotor 60 meshes with each ridge and valley. In addition, eight guide protrusions 73 are equally arranged on the outer periphery of the cam cylindrical portion 71. Each of the guide protrusions 73 fits into either the first guide groove 36 or the second guide groove 37 (Fig. 2F) of the inner barrel 30, and slides forwards and rearwards along either the first guide groove 36 or the second guide groove 37.

(1-5) Non-Writing State

[0034] In the non-writing state illustrated in Fig. 1C, the refill 50 is biased rearwards by the knock spring 11, and accordingly, the rotor 60 and the knock button 70 are also pressed rearwards. As illustrated in Fig. 5 in which the rear end portion of Fig. 1C is enlarged, at this time, the guide protrusion 73 of the knock button 70 fits into the first guide groove 36 or the second guide groove 37 (Fig. 2F) of the inner barrel 30, and the sliding protrusion 67 (not illustrated in Fig. 5) of the rotor fits into the first guide groove 36 (Fig. 2F) of the inner barrel 30. The guide protrusion 73 is in contact with the rear end step 39 of the inner barrel 30 and is prevented from further moving rearwards. In this state, the ballpoint pen tip 53 is retracted into the front barrel 40 (Fig. 1C).

(1-6) Writing State

[0035] Next, the ballpoint pen 10 in the writing state will be described with reference to Figs. 6A to 6C and Fig. 7. Fig. 6A is a front view of the ballpoint pen 10 in the writing state, Fig. 6B is a side view of the ballpoint pen 10 in Fig. 6A, and Fig. 6C is a cross-sectional view taken along line VI-VI in Fig. 6A. Fig. 7 illustrates an enlarged rear end portion of Fig. 6C.

[0036] In a case in which the knock button 70 is pressed from the non-writing state illustrated in Figs. 1A to 1C, as illustrated in Figs. 6A to 6C, the ballpoint pen tip 53 protrudes from the front end of the front barrel 40, and writing becomes possible. Until this state is reached, the following situation occurs inside the inner barrel 30.

[0037] First, in a case in which the knock button 70 is pressed, the rotor 60 is also moved forwards in a state in which the rotation cam 63 meshes with the knock cam 74 as the knock button 70 is moved forwards. At this time, the guide protrusion 73 slides forwards along the first guide groove 36 or the second guide groove 37, and at the same time, the sliding protrusion 67 slides forwards along the first guide groove 36. In a case in which the sliding protrusion 67 leaves the first guide groove 36, the rotation cam 63 is rotated along the inclination of the inner peripheral cam 35, but the rotation stops in a case in which the engagement cam 64 abuts the inner peripheral cam 35 located in the rotation direction. In this state, the rotor 60 is pressed rearwards from the rear end of the refill 50 by biasing force of the knock spring 11, and the state in which the engagement cam 64 is engaged with the inner peripheral cam 35 is maintained. This state is illustrated in Fig. 7.

[0038] At this time, the inclined surface 66 abutting the rear end of the refill 50 in the rotor 60 receives force perpendicular to the axial center by being pressed rearwards. By this force, the inclined cam 64A of the engagement cam 64, the cam surface of which is located closest to the front side, is pressed rearwards. As a result, the rotor 60 is inclined in a direction in which the fulcrum cam 64B is located. Then, the pressing rod 62 inserted into the knock button 70 presses the knock button 70 from the inside in this inclination direction, so that the knock button 70 is fixed so as to be sandwiched between the pressing rod 62 and the inner wall of the rear end opening 38.

[0039] In this state, the knock button 70 is in a free state with respect to the rotor 60 but is fixed as described above, and thus, even if there is vibration associated with writing, the vibration of the knock button 70 is prevented by frictional resistance between the knock button 70 and the rotor 60.

[0040] In a case in which the knock button 70 is pressed again from this writing state, the rotor 60 is moved forwards, so that each of the engagement cams 64 is disengaged from the inner peripheral cam 35. Then, the rotation cam 63 is rotated again along the cam surface of the inner peripheral cam 35, but the sliding protrusion 67 fits into the first guide groove 36 in the rotation direction. In this state, the rotor 60 is moved rearwards by biasing force of the knock spring 11. Then, in a case in which the guide protrusion 73 abuts the rear end step 39, the movement of the rotor is stopped, and the state returns to the non-writing state illustrated in Figs. 1A to 1C again.

(1-7) Summary of First Embodiment

[0041] As described above, the ballpoint pen 10 according to the first embodiment includes the shaft tube 15, the refill 50 that is accommodated in the shaft tube 15 and has a front end protruding and retracting from the shaft tube 15 in conjunction with a knock operation, a knock spring 11 that is interposed between the shaft tube 15 and the refill 50 and biases the refill 50 rearwards, the rotor 60 that includes the cam portion 61 having a substantially cylindrical shape and having a cam formed on the rear end surface of the rotor 60 and the pressing rod 62 protruding toward the rear side from the cam portion

61 and having a smaller diameter than that of the cam portion 61 and that abuts the rear end of the refill 50, the knock button 70 having the internal space into which the pressing rod 62 is inserted so as to abut the knock button 70, the knock button 70 abutting the rear end of the cam portion 61 and partially protruding from the rear end of the shaft tube 15, the inner peripheral cam 35 that is formed on the inner surface in the vicinity of the rear end of the shaft tube 15, the knock cam 74 formed on the front end surface of the knock button 70, the rotation cam 63 that is formed on the rear end surface of the rotor 60 and meshes with the knock cam 74, a plurality of engagement cams 64 that are formed on the outer peripheral side of the rotation cam 63 and mesh with the inner peripheral cam 35, and the inclined surface 66 that is the front end surface of the rotor 60 and is inclined rearwards.

[0042] The ballpoint pen 10 according to the first embodiment is formed such that, in a state in which the rotor 60 is pressed by the knock button 70 and the engagement cam 64 is engaged with the inner peripheral cam 35, the refill 50 is biased rearwards by the knock spring 11, the inclined surface 66 is pressed rearwards by the rear end of the refill 50 such that the rotor 60 is inclined toward the position of the inclined surface 66, closest to a rear side, with respect to an axial center, and the pressing rod 62 presses the inner peripheral surface of the knock button 70 so as to fix the knock button 70 to the shaft tube 15.

[0043] In the ballpoint pen 10 according to the first embodiment, the plurality of engagement cams 64 include the inclined cam 64A that is engaged with the inner peripheral cam 35 at a position closer to the front side than the other cams and that is located on the side of the inclined surface 66, located closest to the front side, and the fulcrum cam 64B that faces the inclined cam 64A with the axial center interposed therebetween, that is engaged with the inner peripheral cam 35 at a position closer to the rear side than the other cams, and that is located on a side of the inclined surface 66, located closest to the rear side. As a result, the inclined cam 64A is engaged with the inner peripheral cam 35, whereby the rotor 60 is inclined in a direction toward the fulcrum cam 64B.

(2) Second Embodiment

(2-1) Overall Configuration of Ballpoint Pen 10

[0044] An overall configuration of the ballpoint pen 10 of a second embodiment will be described with reference to Figs. 8A to 8C. Fig. 8A is a front view of the ballpoint pen 10, Fig. 8B is a side view of the ballpoint pen 10 in Fig. 8A, and Fig. 8C is a cross-sectional view taken along line VIII-VIII in Fig. 8A. Figs. 8A to 8C illustrate the ballpoint pen 10 in the non-writing state.

[0045] As illustrated in Figs. 8A and 8B, the appearance of the ballpoint pen 10 of the second embodiment is not different from the appearance of the ballpoint pen 10 of the first embodiment. The ballpoint pen 10 of the second embodiment has the same configuration as that of the ballpoint pen 10 of the first embodiment except for the configuration of the rotor 60 illustrated in Fig. 8C. Hereinafter, since the overall configuration of the ballpoint pen 10 and the structures of the inner barrel 30 and the knock button 70 are the same as those of the first embodiment, the description thereof will be omitted.

(2-2) Rotor

[0046] The structure of the rotor 60 used in the ballpoint pen 10 of the present embodiment will be described with reference to Figs. 9A to 9G. Fig. 9A is a front view of the rotor 60, Fig. 9B is a side view of the rotor 60, Fig. 9C is a front perspective view of the rotor 60, Fig. 9D is a rear perspective view of the rotor 60, Fig. 9E is a plan view of the rotor 60, Fig. 9F is a bottom view of the rotor 60, and Fig. 9G is a cross-sectional view taken along line IX-IX in Fig. 9A.

[0047] The rotor 60 includes a cam portion 61 that is formed in a substantially cylindrical shape and has a cam formed thereon, and a columnar pressing rod 62 that has a smaller diameter than that of the cam portion 61 and protrudes toward the front end. The serrated rotation cam 63 in which eight ridges and eight valleys are alternately equally arranged is formed on the front end surface of the cam portion 61 (Fig. 9D). On the other hand, the rear end edge of the cam portion 61 is a flange 68 having an increased outer diameter. Four inner peripheral ribs 65 extending in the axial direction are equally arranged on the inner peripheral surface of the cam portion 61 (Fig. 9C, Fig. 9F, and Fig. 9G).

[0048] Four sliding protrusions 67 extending in the axial direction are equally arranged on the outer peripheral surface of the cam portion 61. An engagement cam 64 as an inclined surface, the height of which increases from the right side to the left side when viewed from the front, is formed at the front end of the sliding protrusion 67. The sliding protrusion 67 is formed at a position where the inclination of the engagement cam 64 coincides with the inclination of the rotation cam 63 (Fig. 9A, Fig. 9B, and Fig. 9D). The outer peripheral surface of the sliding protrusion 67 coincides with the outer peripheral surface of the flange 68 (Figs. 9A to 9D and Fig. 9E). The sliding protrusion 67 fits into the first guide groove 36 (Fig. 2F) of the inner barrel 30 and slides back and forth along the first guide groove 36.

[0049] One of the four engagement cams 64 has a cam surface located closer to the front end side than the others, and this is referred to as an inclined cam 64A (Fig. 9B, Fig. 9D, and Fig. 9E). The other one of the four engagement cams 64 has a cam surface located closer to the rear end side than the others, and this is referred to as a fulcrum cam 64B (Fig. 9A, Fig. 9B, Fig. 9D, and Fig. 9E). The cam surface of the fulcrum cam 64B coincides with the cam surface of the rotation cam 63 (Fig. 9B and Fig. 9E). The engagement cam 64 other than the fulcrum cam 64B and the cam surface of the engagement cam 64 are

located closer to the front end side than the cam surface of the rotation cam 63 (Fig. 9A, Fig. 9B, and Fig. 9D).

[0050] The front end surface of the rotor 60 is formed as the inclined surface 66 inclined rearwards (Fig. 9B, Fig. 9C, Fig. 9F, and Fig. 9G). Specifically, the side of the inclined surface 66, located closest to the front side, corresponds to a side on which the inclined cam 64A is located. The side of the inclined surface 66, located closest to the rear side, corresponds to a side on which the fulcrum cam 64B is located (Fig. 9B and Fig. 9G). Further, a front protrusion 69 protrudes in the front end direction from the side of the inclined surface 66, which is closest to the rear side.

(2-3) Non-Writing State

[0051] In the non-writing state illustrated in Fig. 8C, the refill 50 is biased rearwards by the knock spring 11, and accordingly, the rotor 60 and the knock button 70 are also pressed rearwards. As illustrated in Fig. 10 in which the rear end portion of Fig. 8C is enlarged, at this time, the guide protrusion 73 of the knock button 70 fits into the first guide groove 36 or the second guide groove 37 (Fig. 2F) of the inner barrel 30, and the sliding protrusion 67 (not illustrated in Fig. 5) of the rotor fits into the first guide groove 36 (Fig. 2F) of the inner barrel 30. The guide protrusion 73 is in contact with the rear end step 39 of the inner barrel 30 and is prevented from further moving rearwards. In this state, the ballpoint pen tip 53 is retracted into the front barrel 40 (Fig. 8C).

(2-4) Writing State

[0052] Next, the ballpoint pen 10 in the writing state will be described with reference to Figs. 11A to 11C and Fig. 12. Fig. 11A is a front view of the ballpoint pen 10 in the writing state, Fig. 11B is a side view of the ballpoint pen 10 in Fig. 11A, and Fig. 11C is a cross-sectional view taken along line XI-XI in Fig. 11A. Fig. 12 illustrates an enlarged rear end portion of Fig. 12C.

[0053] In a case in which the knock button 70 is pressed from the non-writing state illustrated in Figs. 8A to 8C, as illustrated in Figs. 11A to 11C, the ballpoint pen tip 53 protrudes from the front end of the front barrel 40, and writing becomes possible. Until this state is reached, the following situation occurs inside the inner barrel 30.

[0054] First, in a case in which the knock button 70 is pressed, the rotor 60 is also moved forwards in a state in which the rotation cam 63 meshes with the knock cam 74 as the knock button 70 is moved forwards. At this time, the guide protrusion 73 slides forwards along the first guide groove 36 or the second guide groove 37, and at the same time, the sliding protrusion 67 slides forwards along the first guide groove 36. In a case in which the sliding protrusion 67 leaves the first guide groove 36, the rotation cam 63 is rotated along the inclination of the inner peripheral cam 35, but the rotation stops in a case in which the engagement cam 64 abuts the inner peripheral cam 35 located in the rotation direction. In this state, the rotor 60 is pressed rearwards from the rear end of the refill 50 by biasing force of the knock spring 11, and the state in which the engagement cam 64 is engaged with the inner peripheral cam 35 is maintained. This state is illustrated in Fig. 12.

[0055] At this time, the inclined surface 66 abutting the rear end of the refill 50 in the rotor 60 receives force perpendicular to the axial center by being pressed rearwards. At this time, the side of the rear end of the refill 50, located on the fulcrum cam 64B side, is subjected to reaction rightwards when viewed from Fig. 12 by the abutting front protrusion 69. This reaction strengthens force of pressing the side of the rear end of the refill 50, located on the side of the inclined cam 64A, rearwards. By this force, the inclined cam 64A of the engagement cam 64, the cam surface of which is located closest to the front side, is pressed rearwards. As a result, the rotor 60 is inclined in a direction in which the fulcrum cam 64B is located. Then, the pressing rod 62 inserted into the knock button 70 presses the knock button 70 from the inside in this inclination direction, so that the knock button 70 is fixed so as to be sandwiched between the pressing rod 62 and the inner wall of the rear end opening 38.

[0056] In this state, the knock button 70 is in a free state with respect to the rotor 60, but since the knock button 70 is fixed as described above, vibration associated with writing is prevented.

[0057] In a case in which the knock button 70 is pressed again from this writing state, the rotor 60 is moved forwards, so that each of the engagement cams 64 is disengaged from the inner peripheral cam 35. Then, the rotation cam 63 is rotated again along the cam surface of the inner peripheral cam 35, but the sliding protrusion 67 fits into the first guide groove 36 in the rotation direction. In this state, the rotor 60 is moved rearwards by biasing force of the knock spring 11. Then, in a case in which the guide protrusion 73 abuts the rear end step 39, the movement of the rotor is stopped, and the state returns to the non-writing state illustrated in Figs. 8A to 8C again.

(2-5) Summary of Second Embodiment

[0058] As described above, the ballpoint pen 10 according to the second embodiment includes the shaft tube 15, the refill 50 that is accommodated in the shaft tube 15 and has a front end protruding and retracting from the shaft tube 15 in conjunction with a knock operation, a knock spring 11 that is interposed between the shaft tube 15 and the refill 50 and biases the refill 50 rearwards, the rotor 60 that includes the cam portion 61 having a substantially cylindrical shape and having a cam formed on the rear end surface of the rotor 60 and the pressing rod 62 protruding rearwards from the cam portion 61 and having a smaller diameter and that abuts the rear end of the refill 50, the knock button 70 having the internal space into which the pressing rod 62 is inserted so as to abut the knock button 70, the knock button 70 abutting the rear

end of the cam portion 61 and partially protruding from the rear end of the shaft tube 15, the inner peripheral cam 35 that is formed on the inner surface in the vicinity of the rear end of the shaft tube 15, the knock cam 74 formed on the front end surface of the knock button 70, the rotation cam 63 that is formed on the rear end surface of the rotor 60 and meshes with the knock cam 74, a plurality of engagement cams 64 that are formed on the outer peripheral side of the rotation cam 63 and mesh with the inner peripheral cam 35, and the inclined surface 66 that is the front end surface of the rotor 60 and is inclined rearwards.

[0059] The ballpoint pen 10 according to the second embodiment is formed such that, in a state in which the rotor 60 is pressed by the knock button 70 and the engagement cam 64 is engaged with the inner peripheral cam 35, the refill 50 is biased rearwards by the knock spring 11, the inclined surface 66 is pressed rearwards by the rear end of the refill 50 such that the rotor 60 is inclined toward the position of the inclined surface 66, closest to a rear side, with respect to an axial center, and the pressing rod 62 presses the inner peripheral surface of the knock button 70 so as to fix the knock button 70 to the shaft tube 15.

[0060] In the ballpoint pen 10 according to the second embodiment, the plurality of engagement cams 64 include the inclined cam 64A that is engaged with the inner peripheral cam 35 at a position closer to the front side than the other cams and that is located on the side of the inclined surface 66, located closest to the front side, and the fulcrum cam 64B that faces the inclined cam 64A with the axial center interposed therebetween, that is engaged with the inner peripheral cam 35 at a position closer to the rear side than the other cams, and that is located on a side of the inclined surface 66, located closest to the rear side. As a result, the inclined cam 64A is engaged with the inner peripheral cam 35, whereby the rotor 60 is inclined in a direction toward the fulcrum cam 64B.

[0061] In the ballpoint pen 10 according to the second embodiment, the front protrusion 69 protruding toward the front side is further formed on a side of the inclined surface 66, in which the fulcrum cam 64B is provided.

[0062] In both the first embodiment and the second embodiment, the knock button 70 and the rotor 60 are fixed to each other. However, even if the knock button 70 and the rotor 60 are fixed to each other by the guide protrusion 73 of the knock button 70 and the second guide groove 37 of the inner barrel 30, it is possible to obtain an effect of preventing vibration of the knock button 70 during writing.

INDUSTRIAL APPLICABILITY

[0063] The embodiment of the present disclosure is applicable to a retractable ballpoint pen.

Claims

1. A ballpoint pen, comprising:

a shaft tube;
a refill accommodated in the shaft tube, the refill having a front end protruding and retracting from the shaft tube in conjunction with a knock operation;
a knock spring interposed between the shaft tube and the refill, the knock spring biasing the refill rearwards;
a rotor including a cam portion having a cam formed on a rear end surface of the rotor, the cam portion having a substantially cylindrical shape, and a pressing rod protruding rearwards from the cam portion, the pressing rod having a rod-like shape with a smaller diameter than a diameter of the cam portion, the rotor abutting a rear end of the refill;
a knock button having an internal space into which the pressing rod is inserted so as to abut the knock button, the knock button abutting a rear end of the cam portion and partially protruding from a rear end of the shaft tube;
an inner peripheral cam formed on an inner surface near the rear end of the shaft tube;
a knock cam formed on a front end surface of the knock button;
a rotation cam formed on the rear end surface of the rotor, the rotation cam meshing with the knock cam;
a plurality of engagement cams formed on an outer peripheral side of the rotation cam, the engagement cams meshing with the inner peripheral cam; and
an inclined surface that is a front end surface of the rotor, the inclined surface being inclined rearwards,
wherein the ballpoint pen is formed such that, in a state in which the rotor is pressed by the knock button and the engagement cams are engaged with the inner peripheral cam,
the refill is biased rearwards by the knock spring,
the inclined surface is pressed rearwards by the rear end of the refill such that the rotor is inclined toward a position of the inclined surface, the position being closest to a rear side with respect to an axial center, and
the pressing rod presses an inner peripheral surface of the knock button so as to fix the knock button to the shaft tube.

2. The ballpoint pen according to claim 1, wherein:
the plurality of engagement cams include:

an inclined cam engaged with the inner peripheral cam at a position closer to a front side than

other cams, the inclined cam being located on a side of the inclined surface, the side being located closest to the front side; and
a fulcrum cam facing the inclined cam with the axial center interposed therebetween, the fulcrum cam being engaged with the inner peripheral cam at a position closer to the rear side than the other cams and being located on a side of the inclined surface, the side being located closest to the rear side, and
the inclined cam is engaged with the inner peripheral cam such that the rotor is inclined in a direction toward the fulcrum cam.

3. The ballpoint pen according to claim 2, wherein a front protrusion protruding toward the front side is formed on a side of the inclined surface, the side having the fulcrum cam provided thereon.

FIG.1A

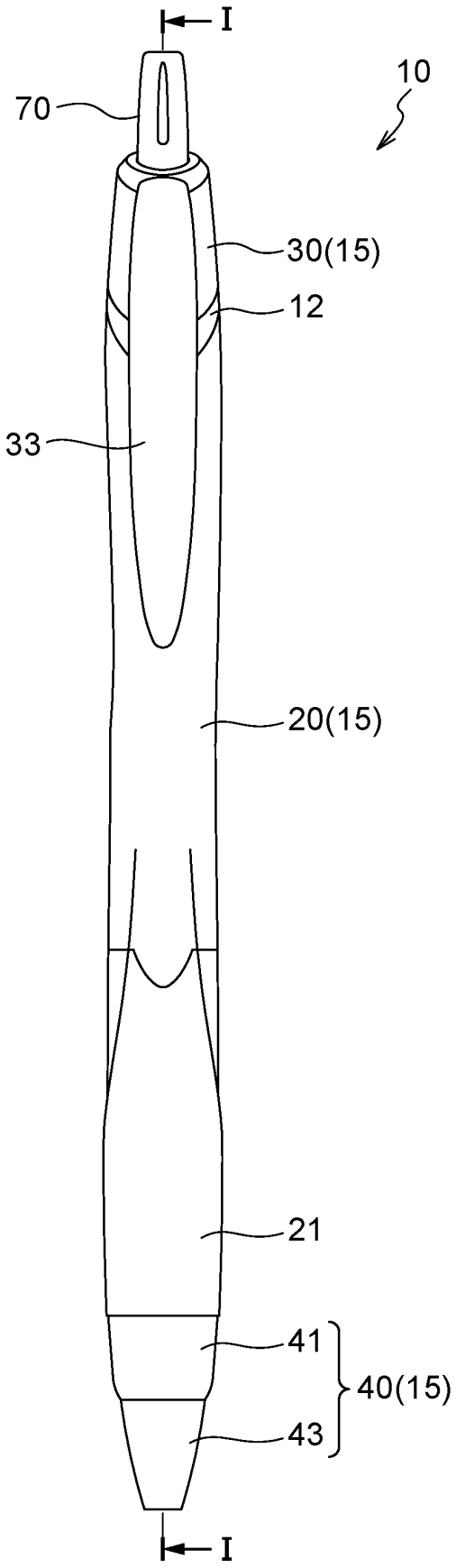


FIG.1B

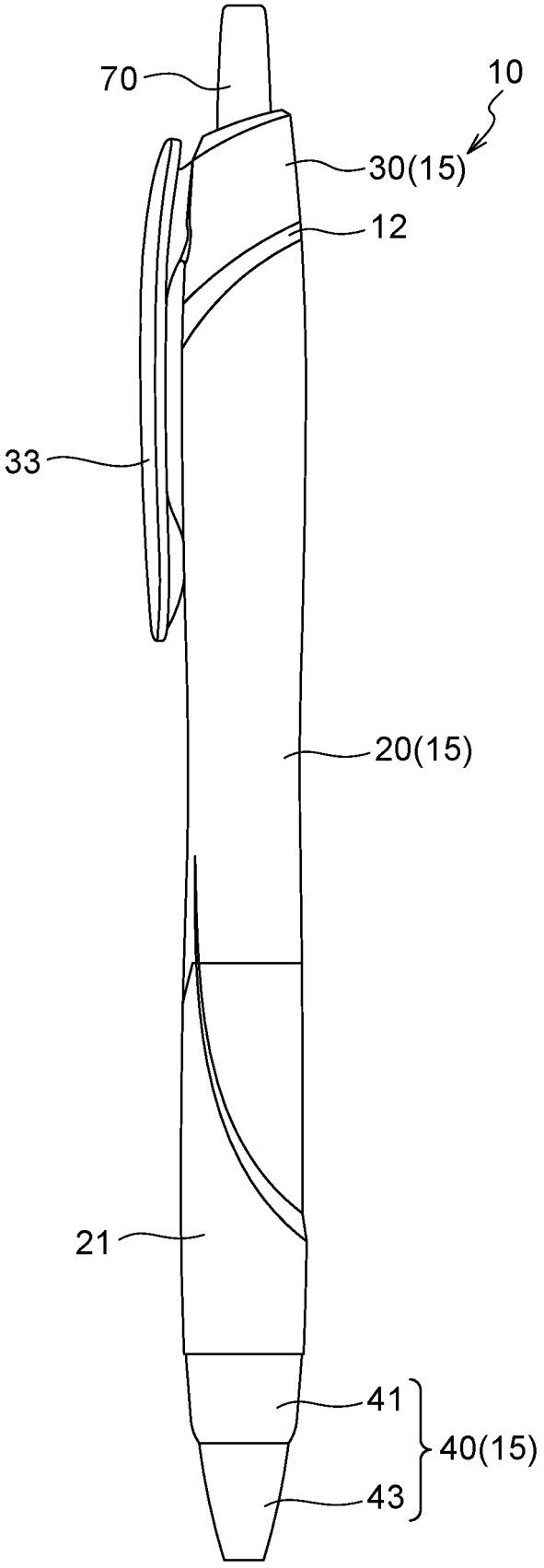
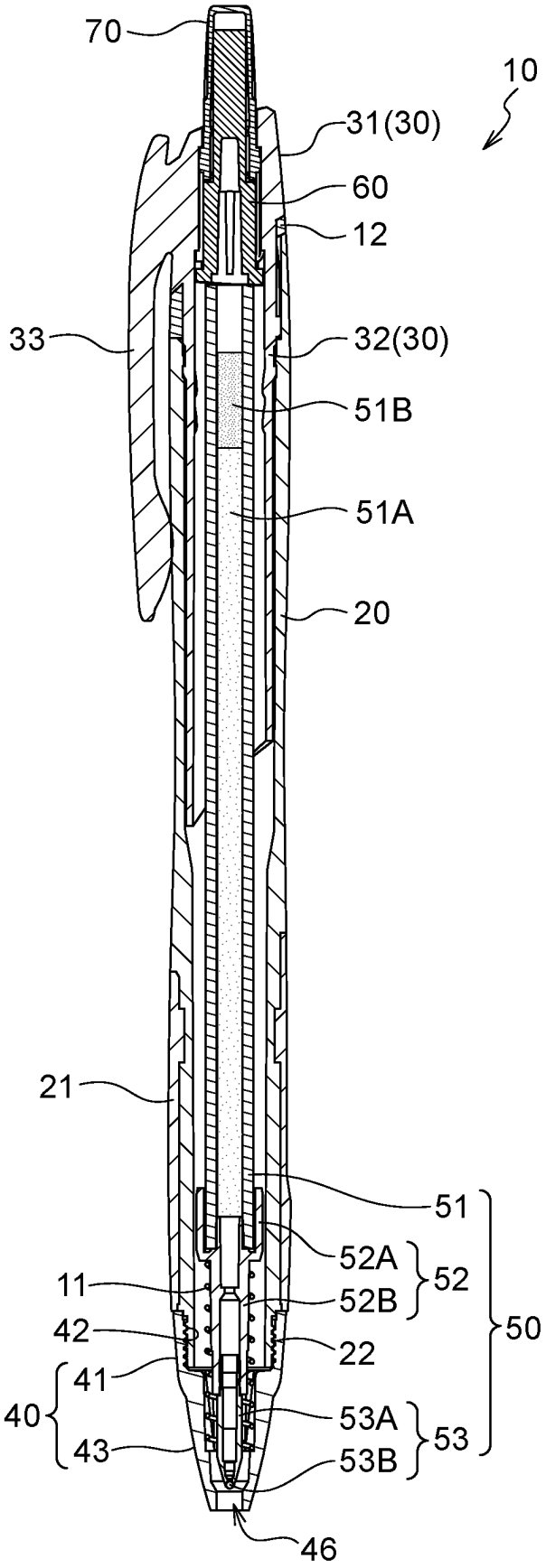


FIG.1C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60
12
33
32(30)
51B
51A
20
21
51
52A
52
11
52B
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41
40
53A
53
43
53B
46

FIG.2A

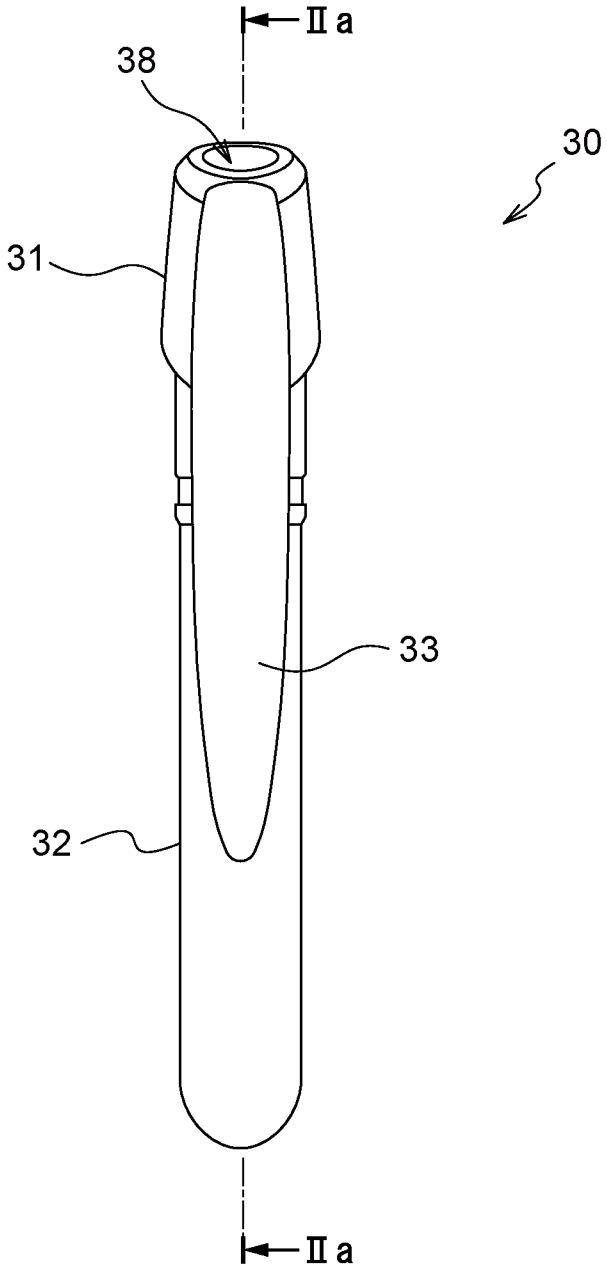


FIG.2B

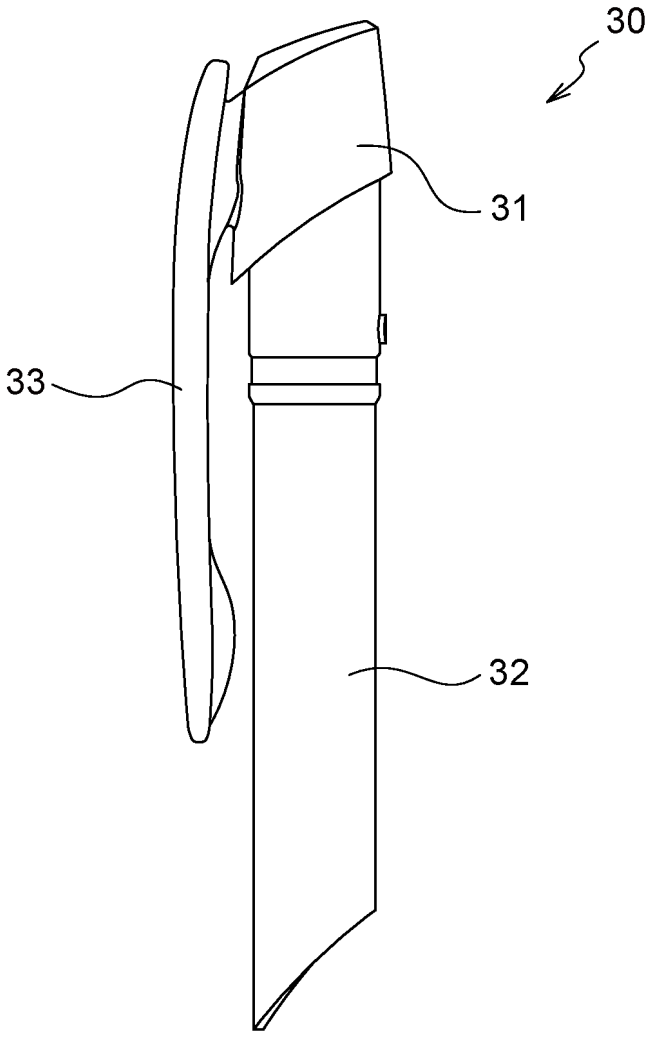


FIG.2C

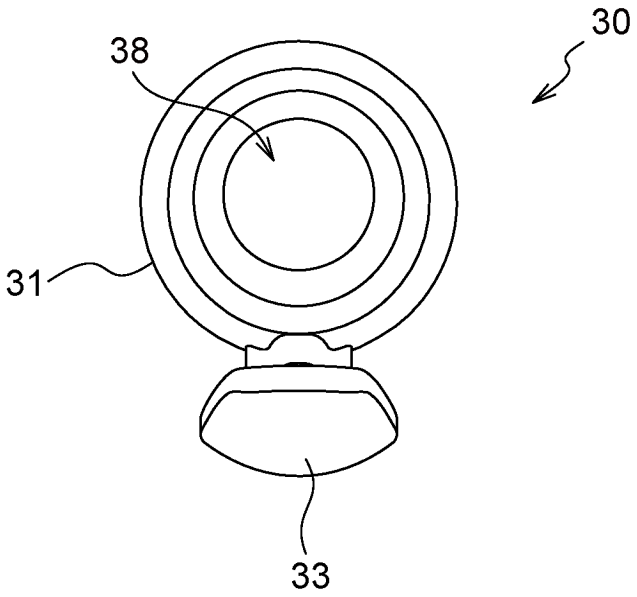


FIG.2D

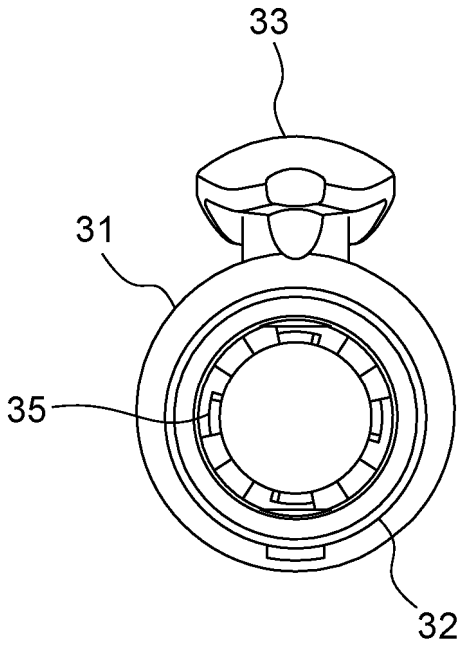


FIG.2E

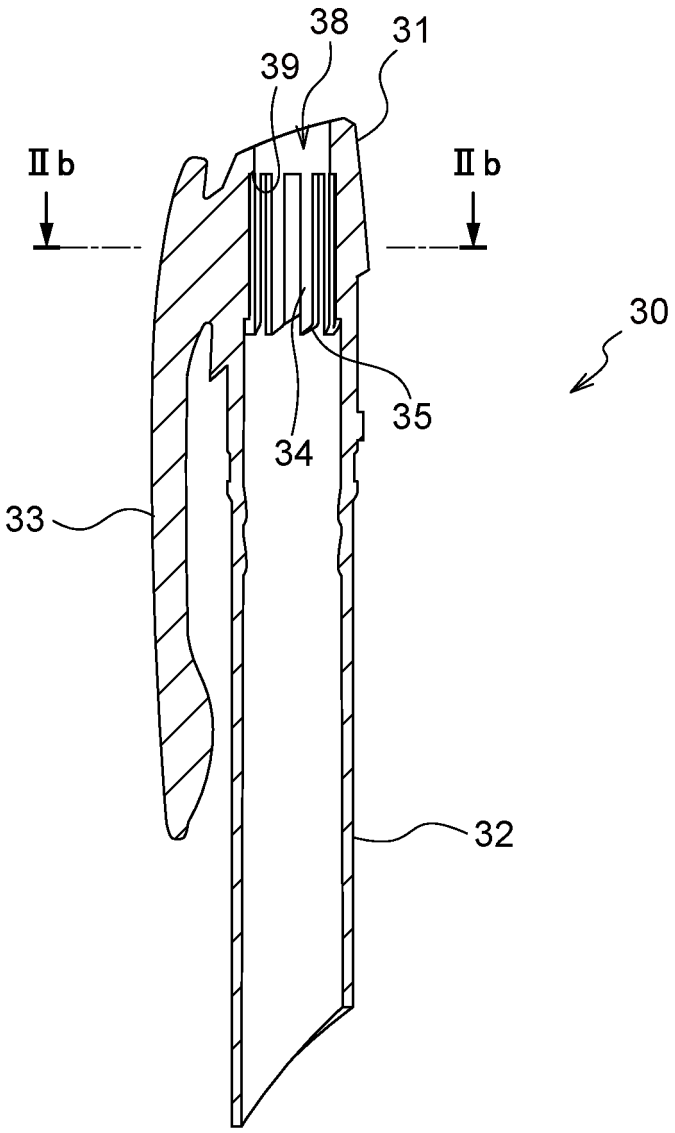


FIG.2F

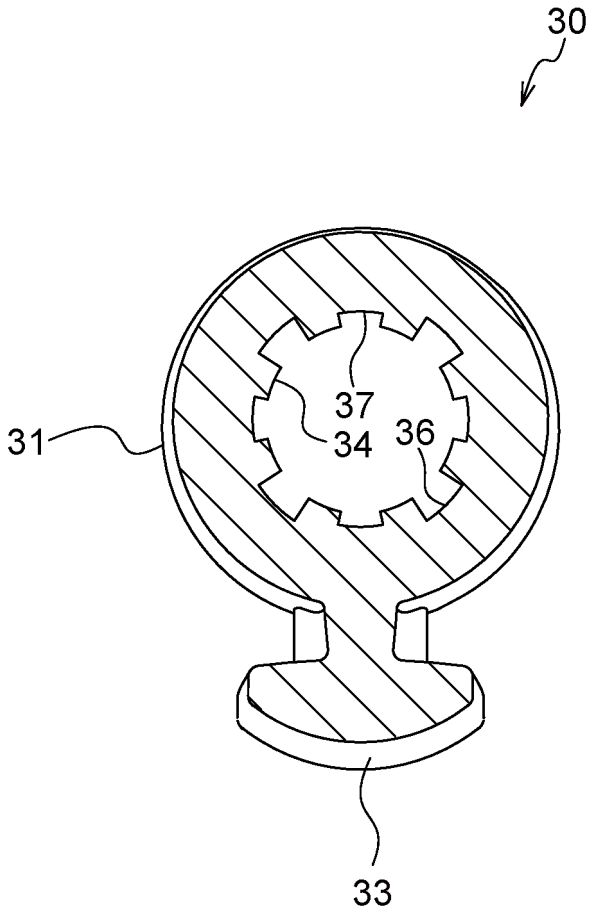


FIG.3A

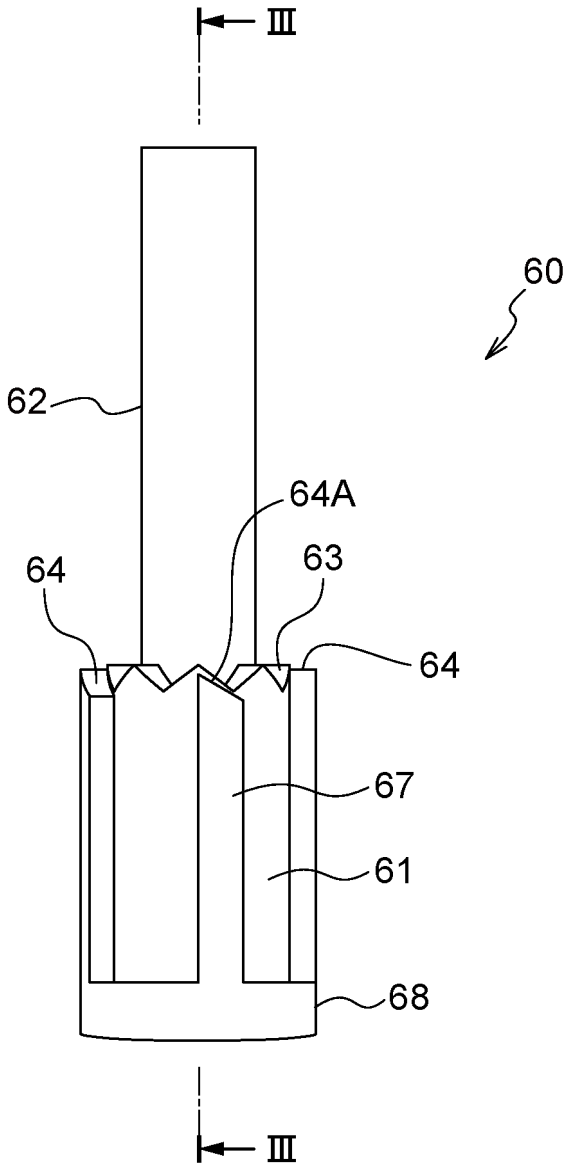


FIG.3B

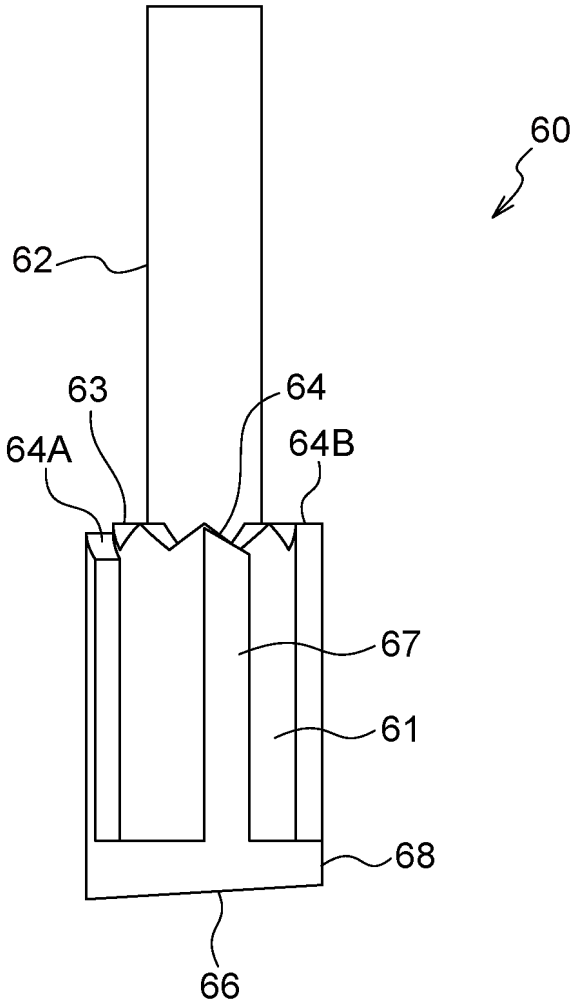


FIG.3C

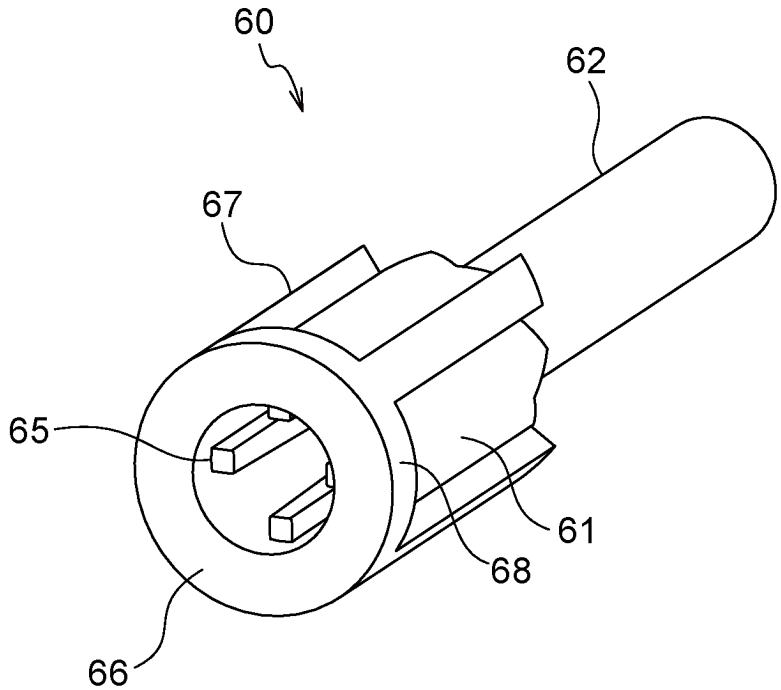


FIG.3D

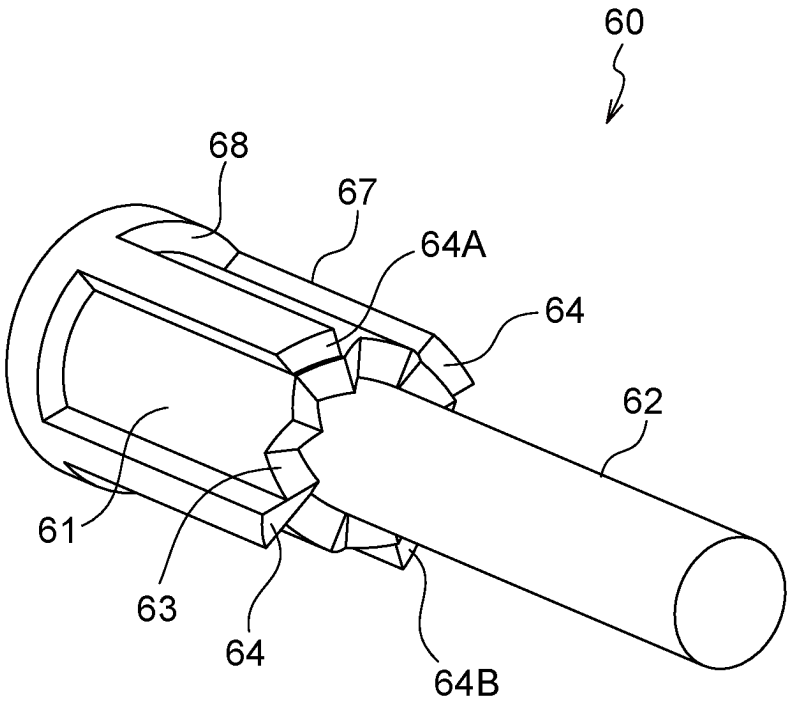


FIG.3E

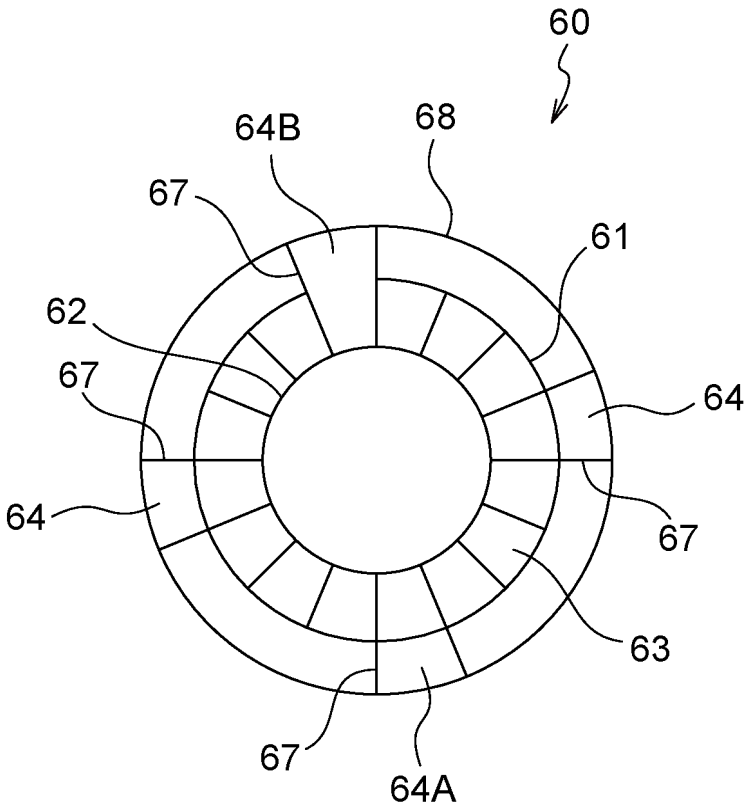


FIG.3F

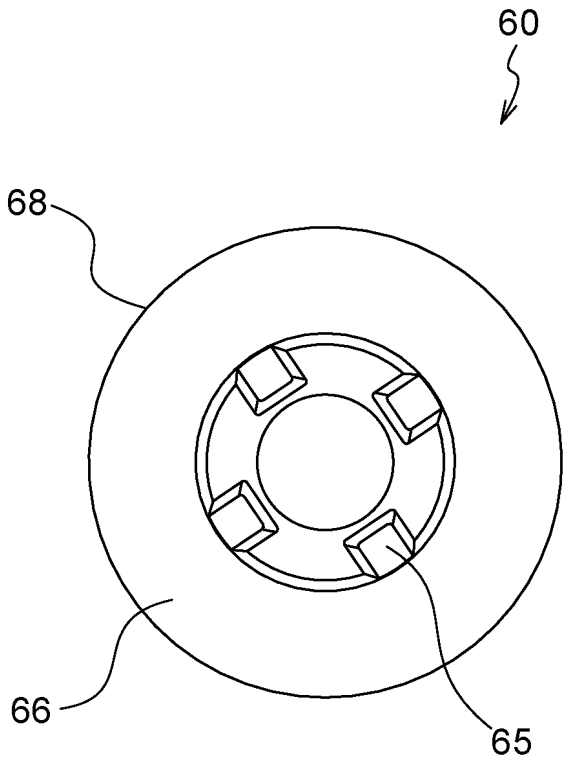


FIG.3G

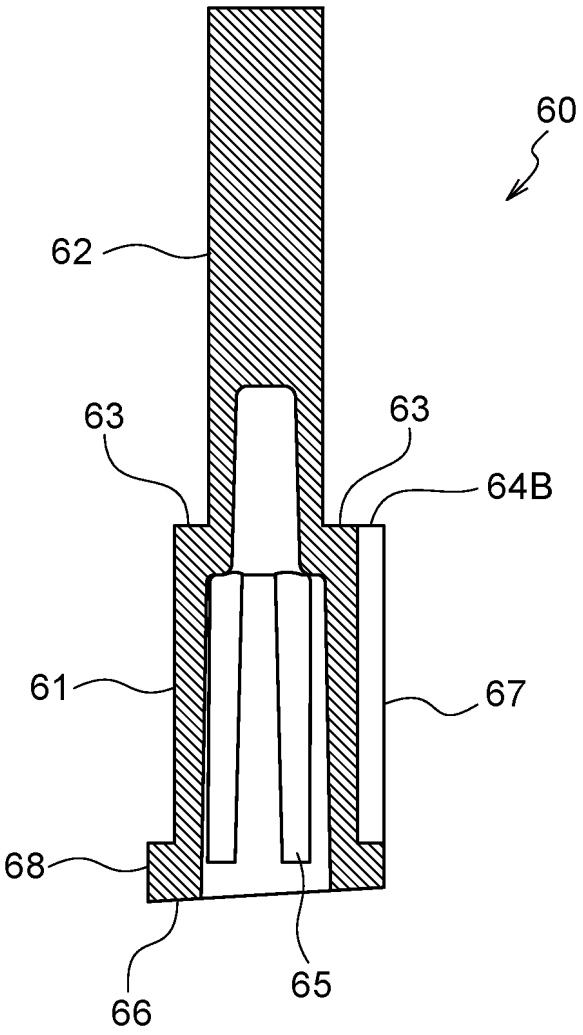


FIG.4A

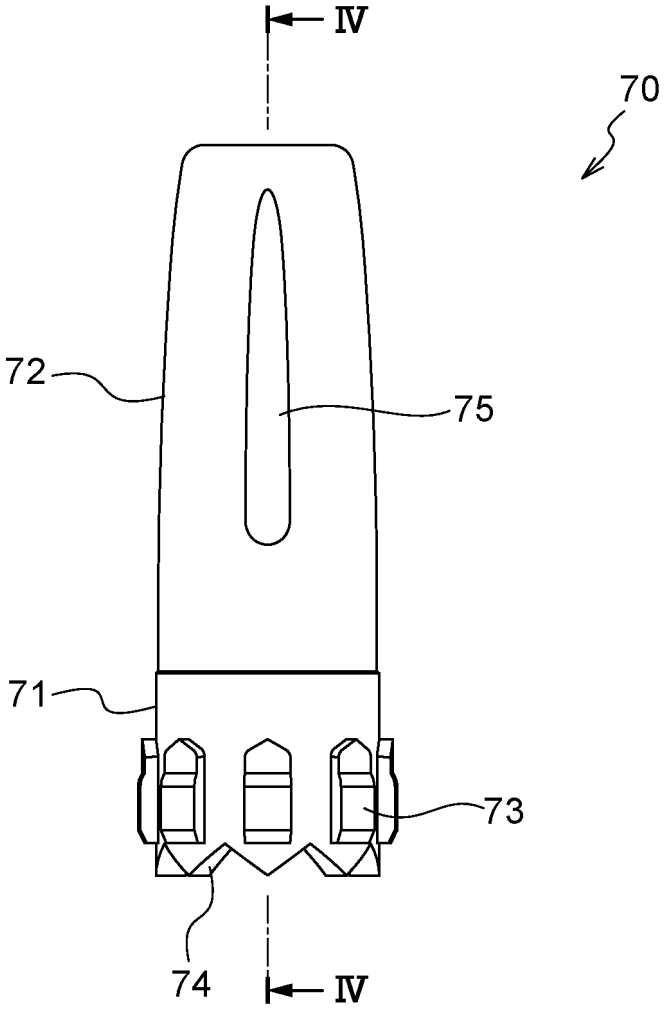


FIG.4B

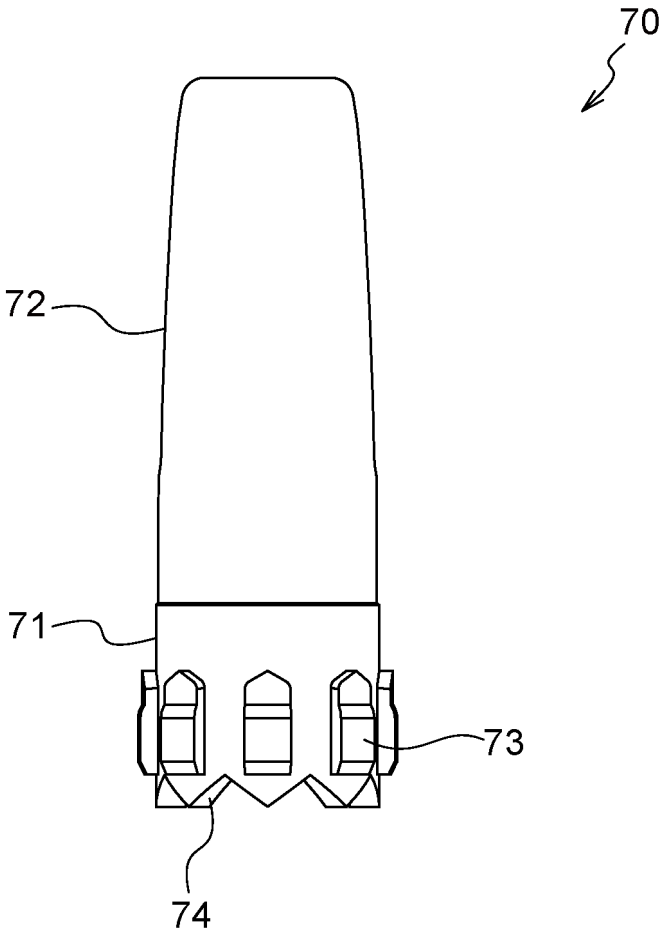


FIG.4C

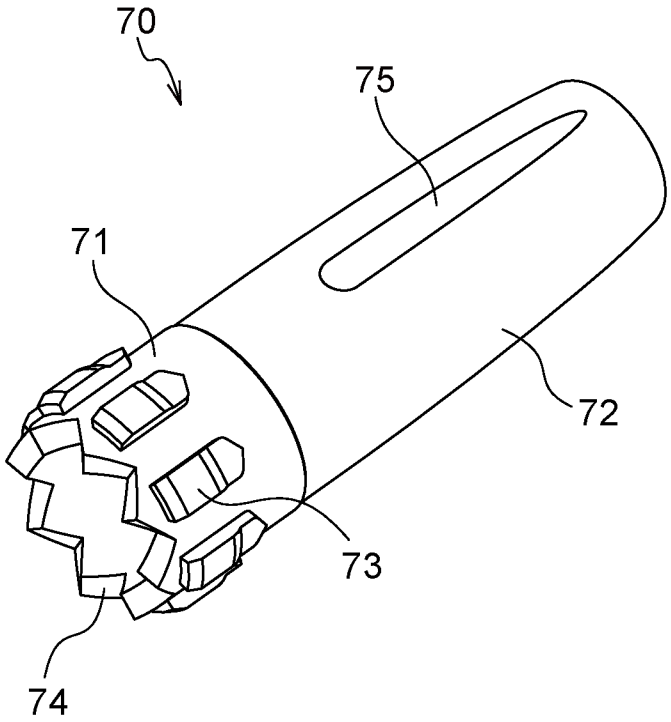


FIG.4D

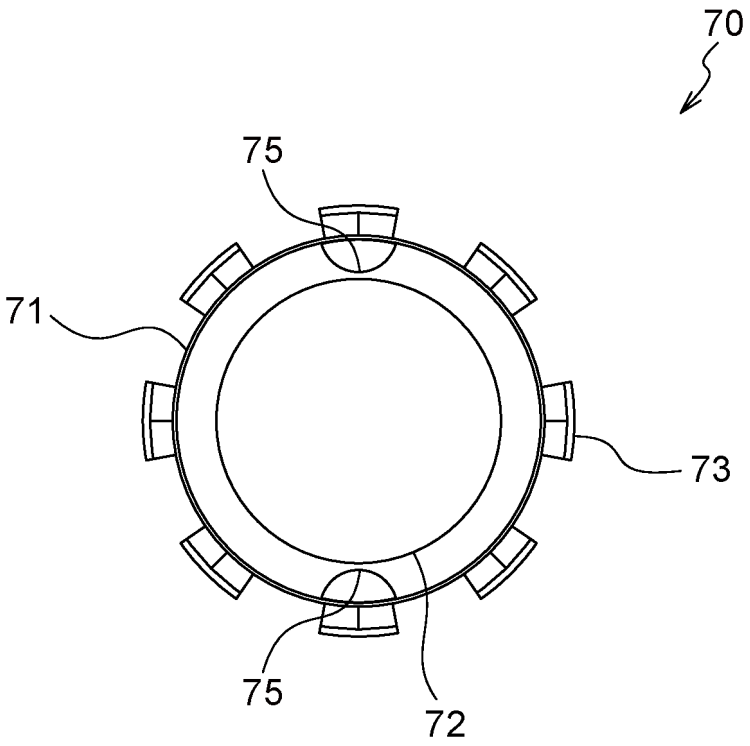


FIG.4E

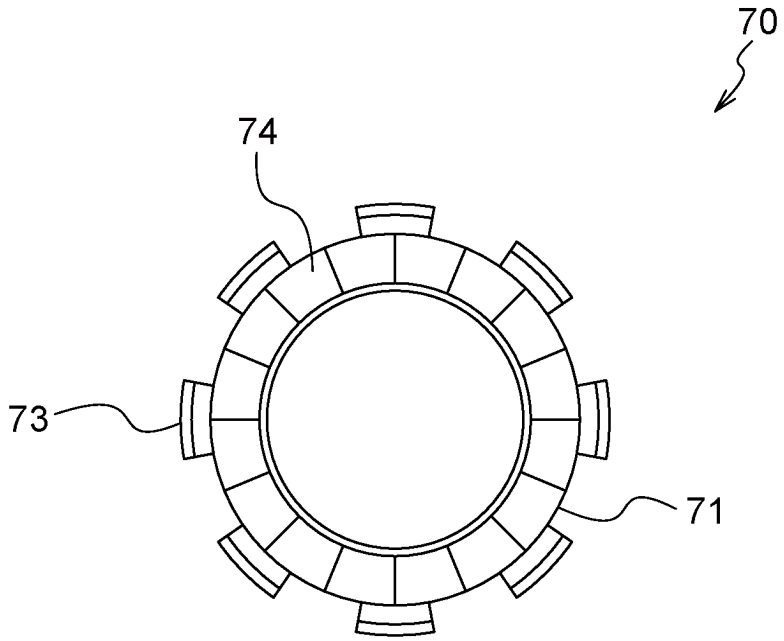


FIG.4F

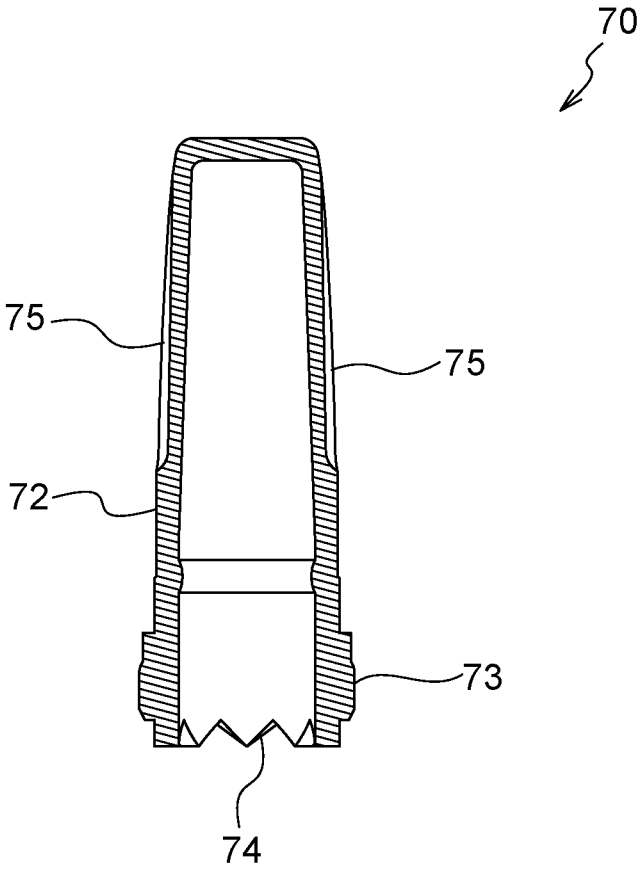


FIG.5

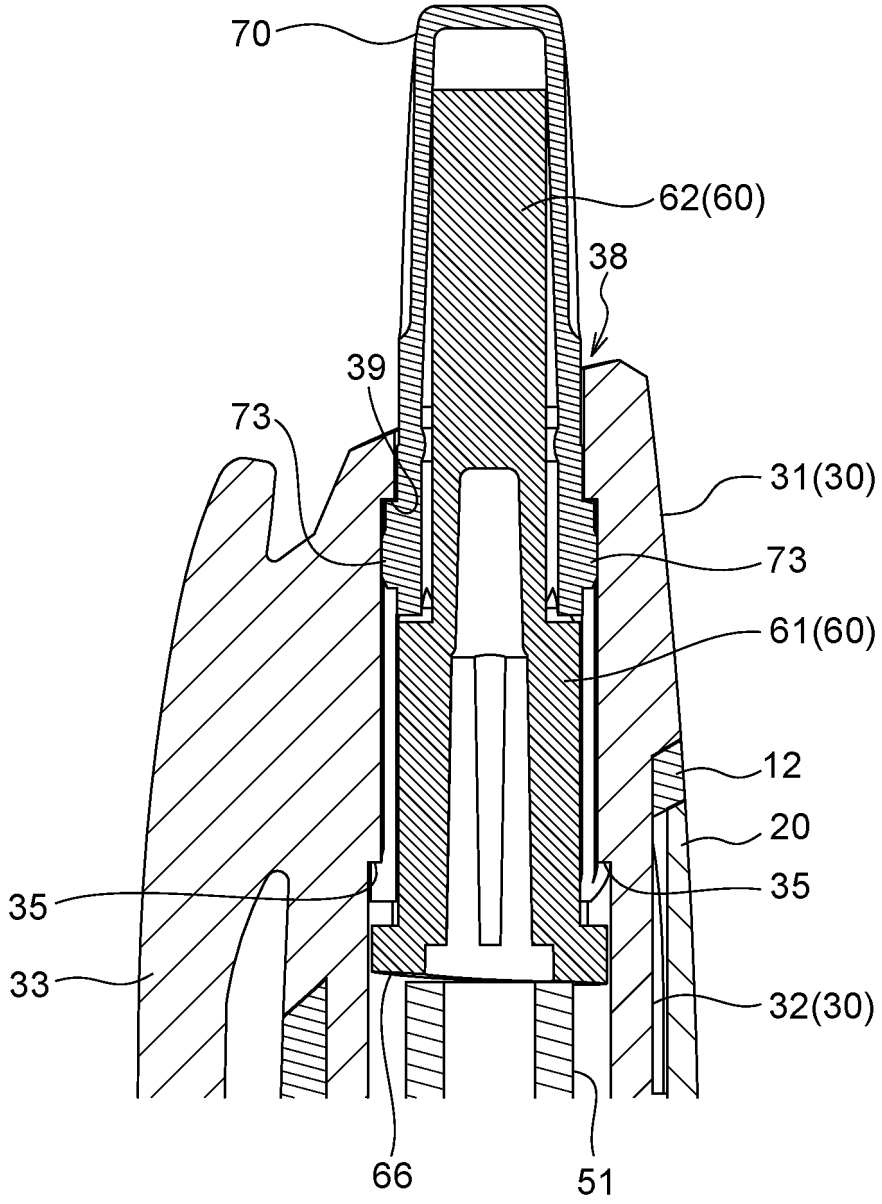


FIG.6A

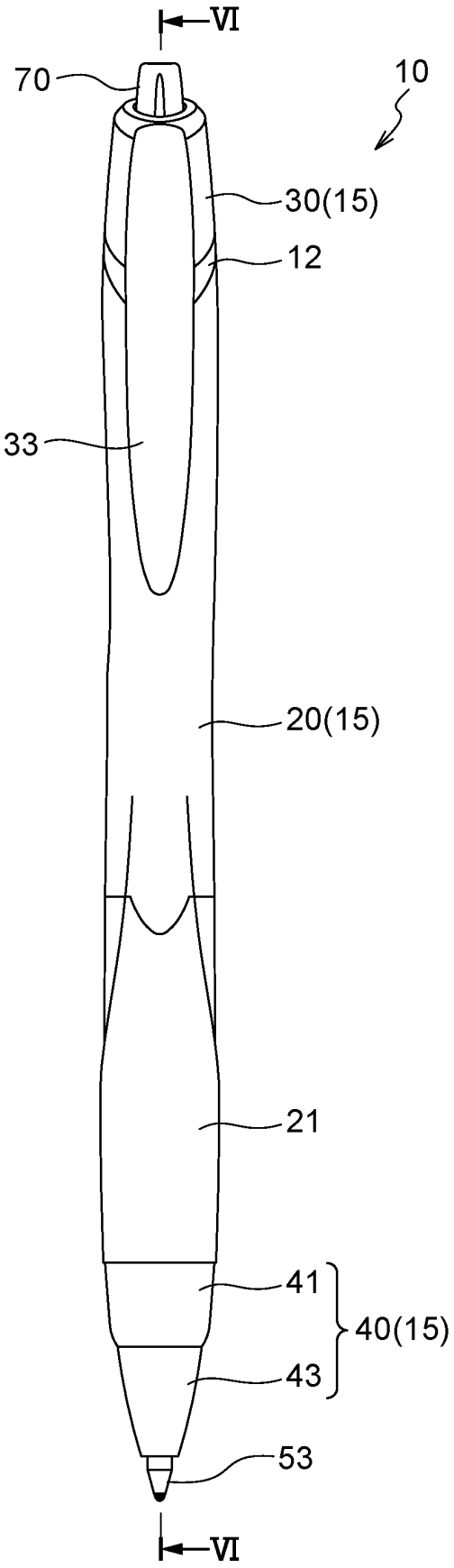


FIG.6B

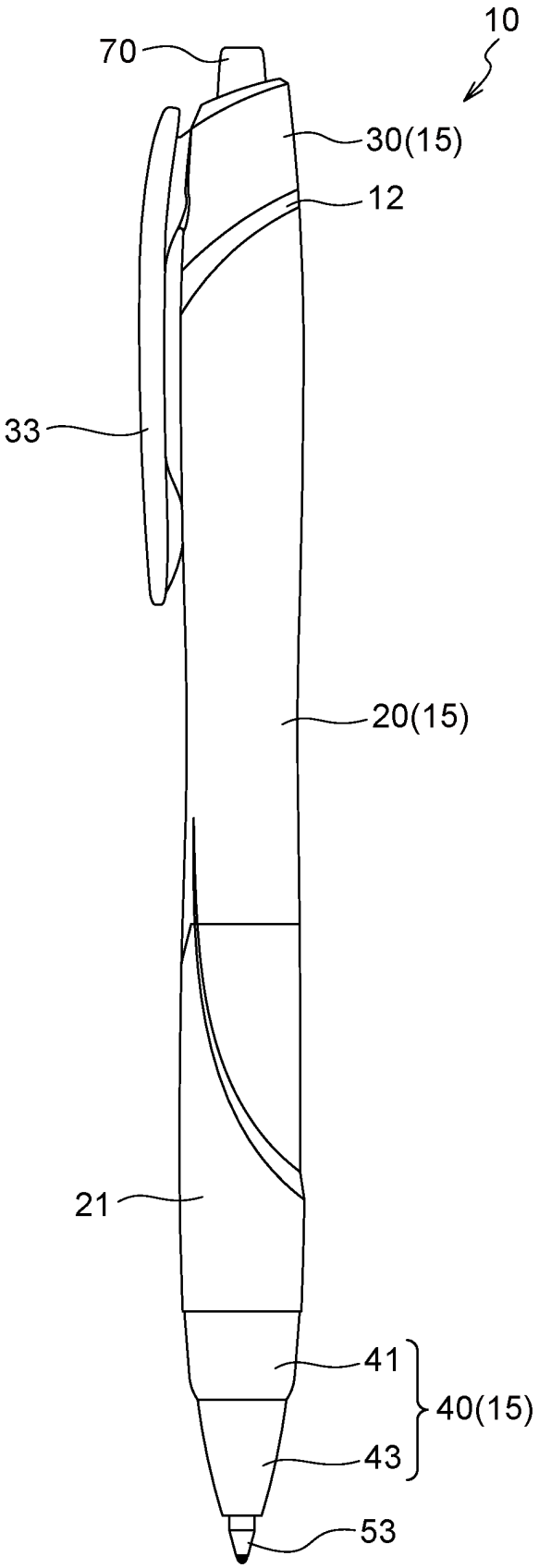
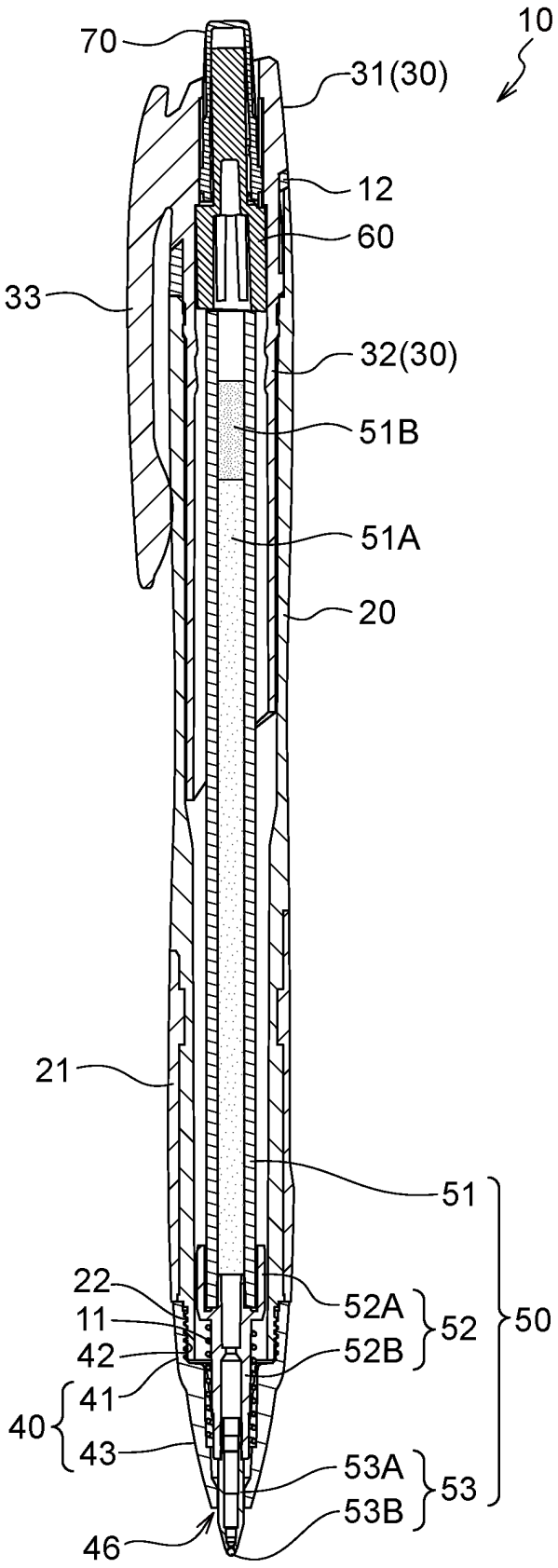


FIG.6C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33
32(30)
51B
51A
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42
52B
41
40
43
53A
53
53B
46

FIG.7

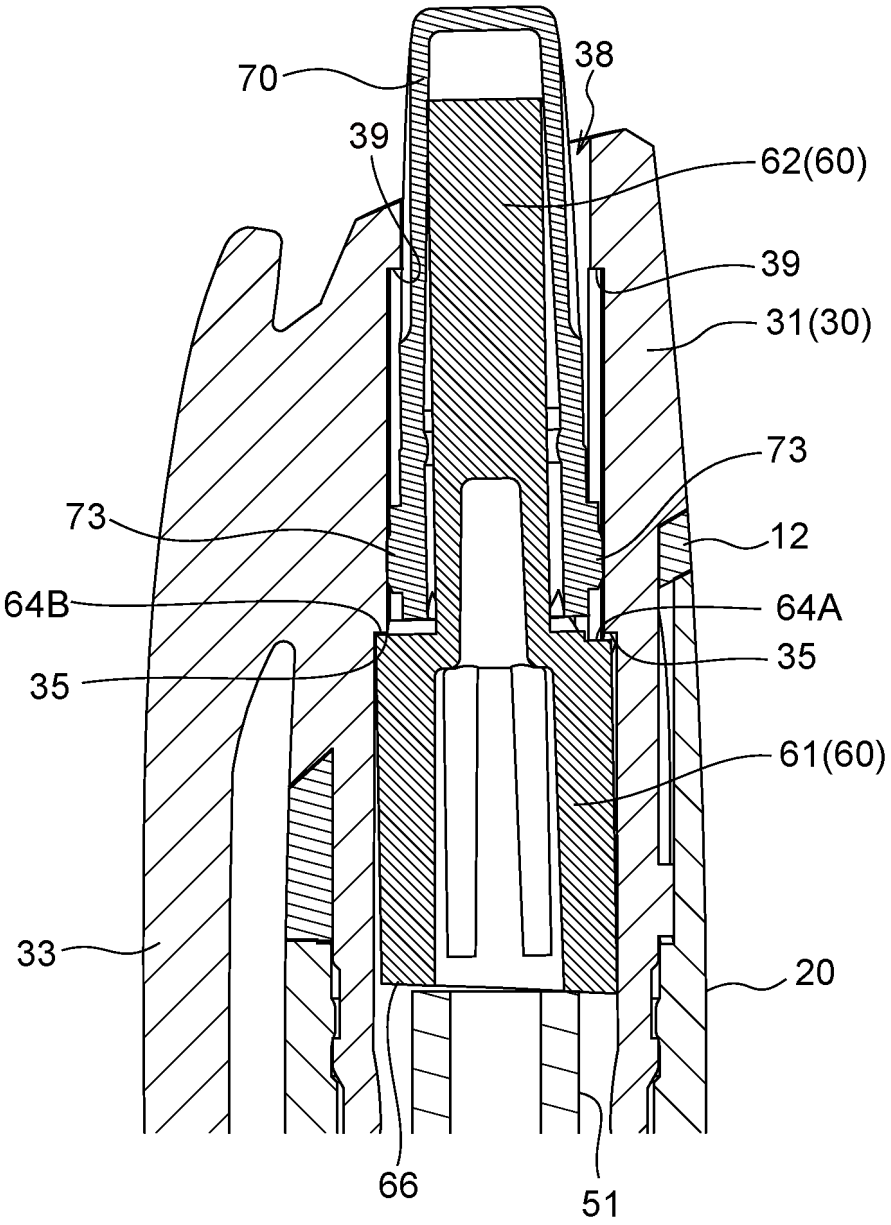


FIG.8A

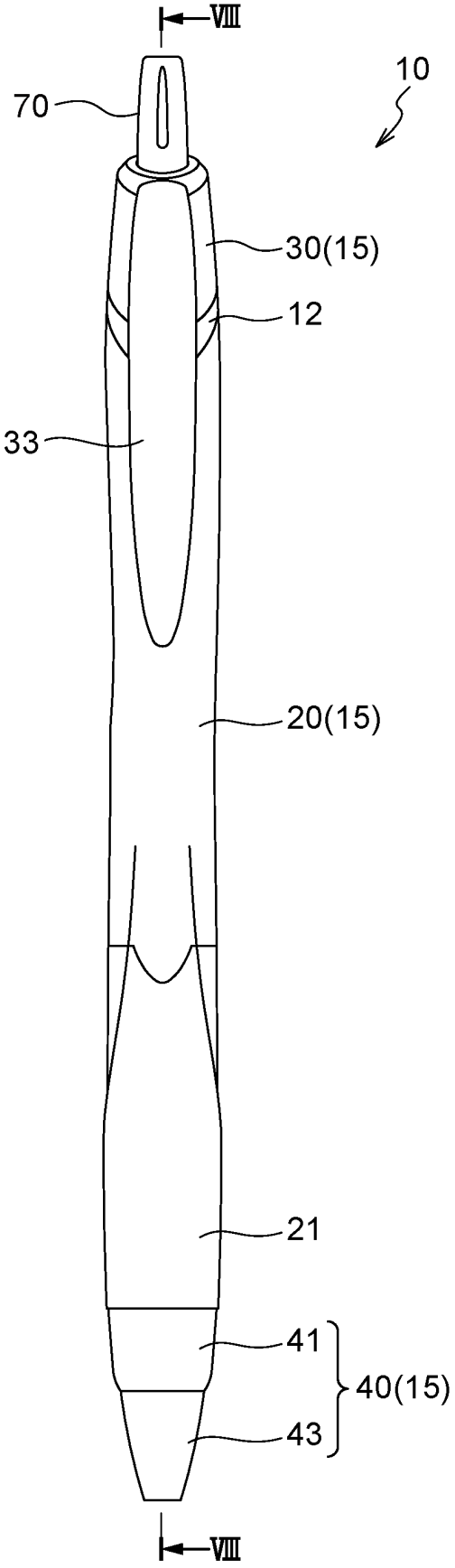


FIG.8B

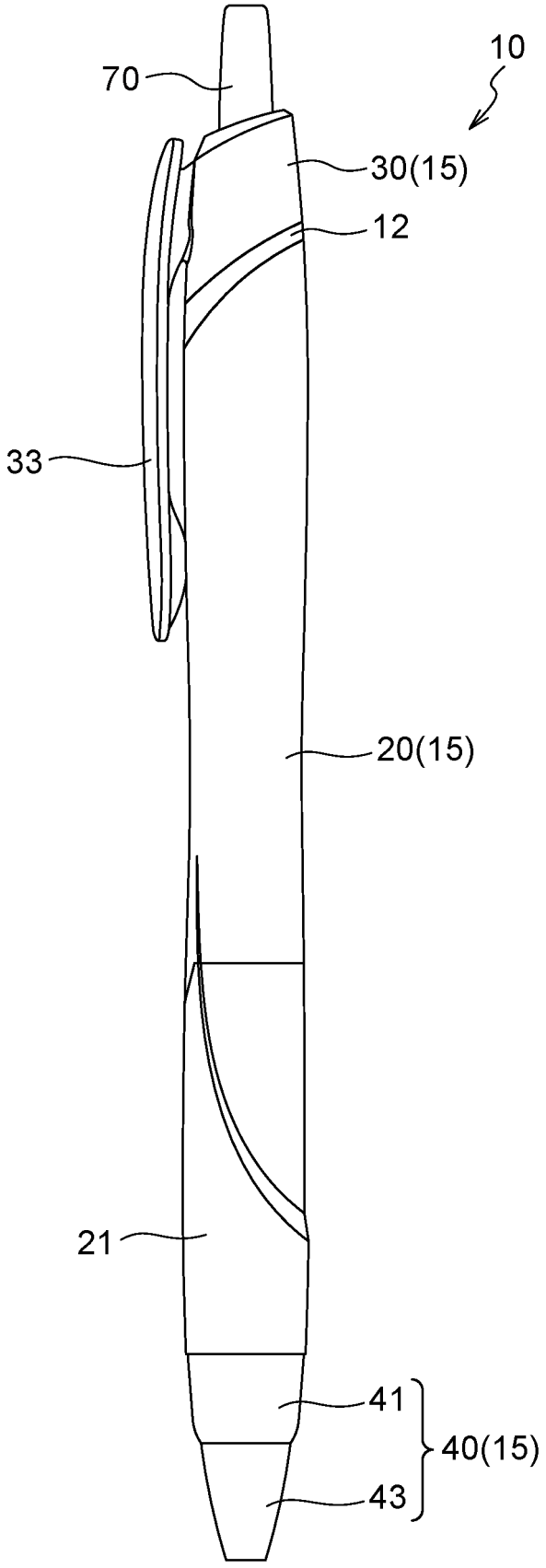
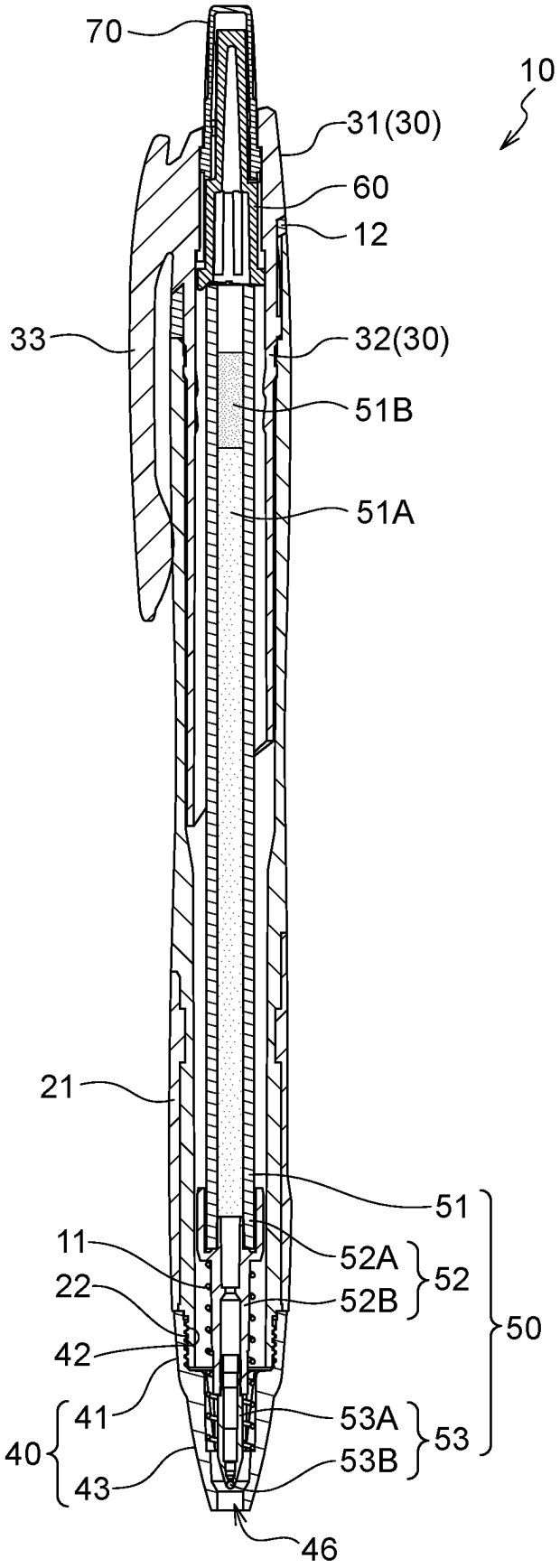


FIG.8C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41
53A
53
40
53B
43
46

FIG.9A

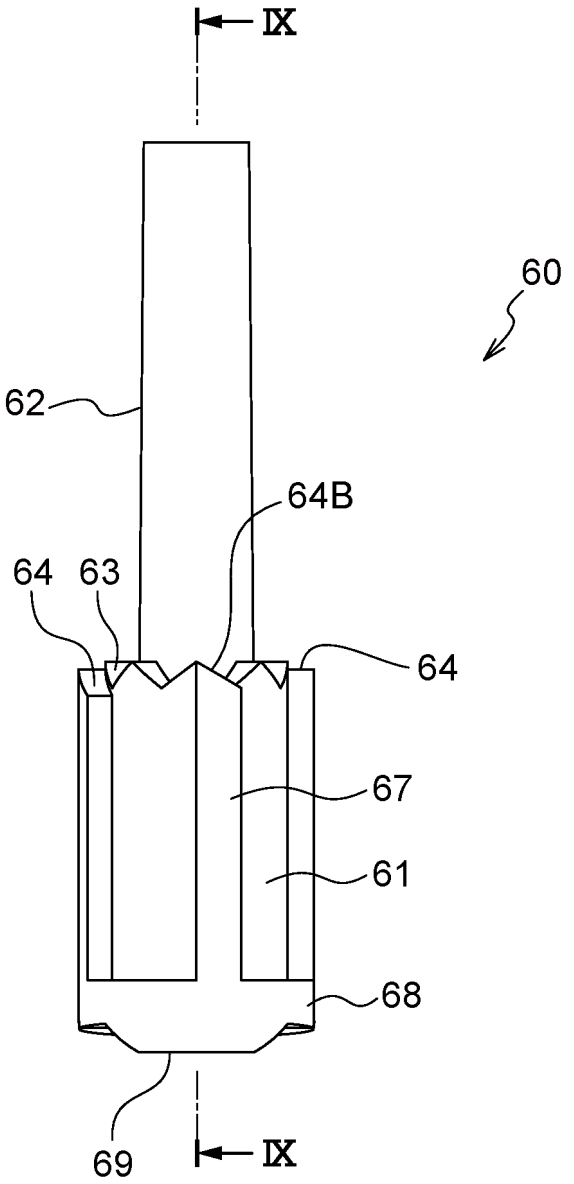


FIG.9B

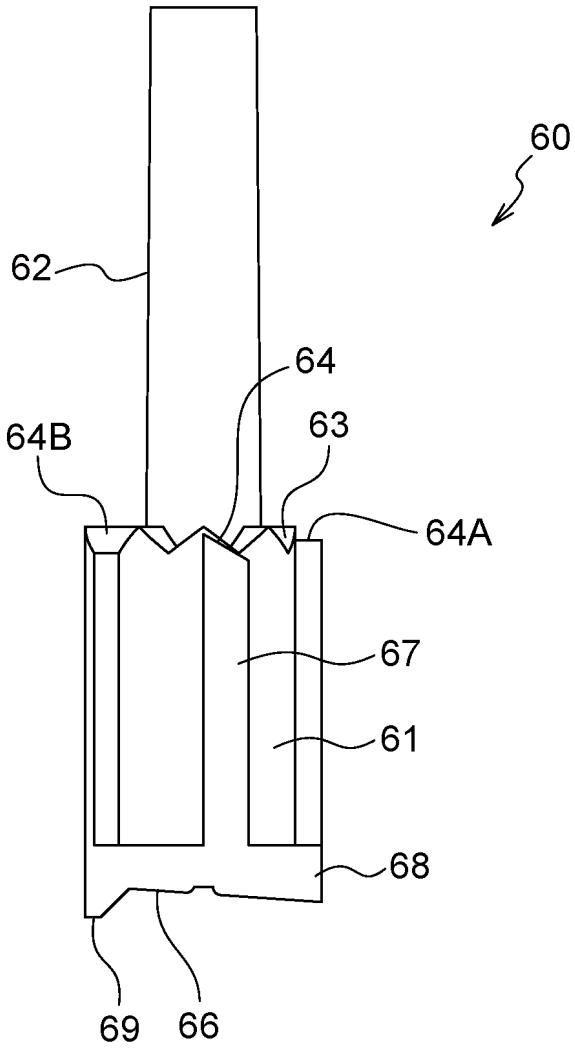


FIG.9C

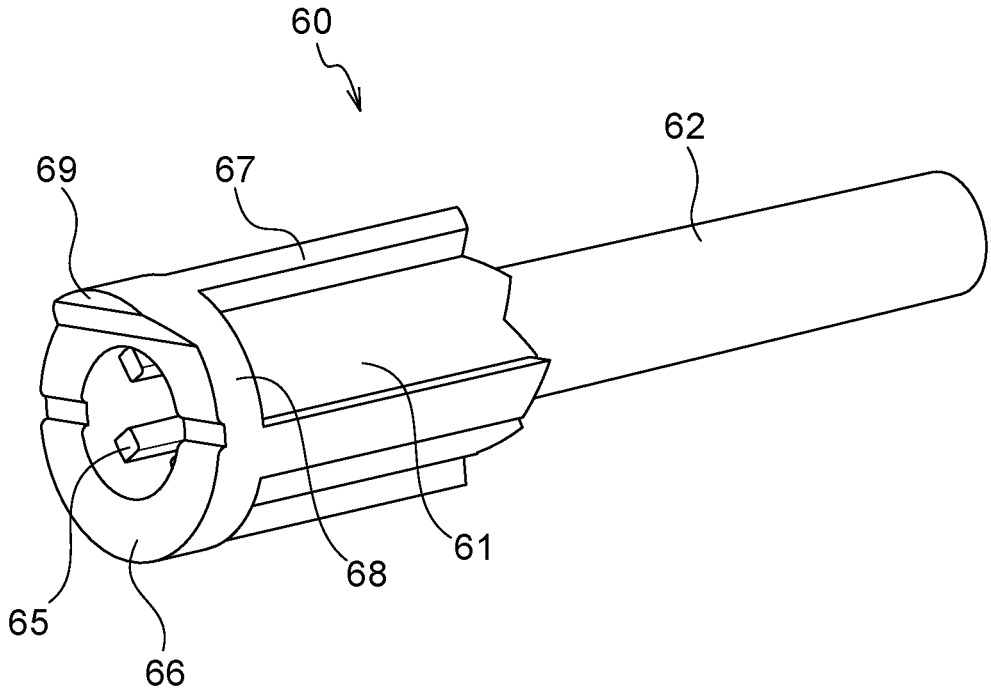


FIG.9D

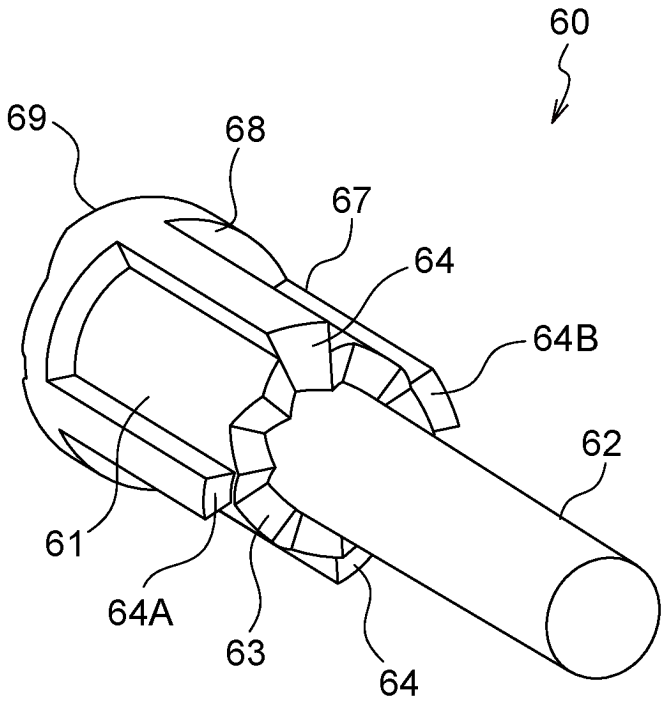


FIG.9E

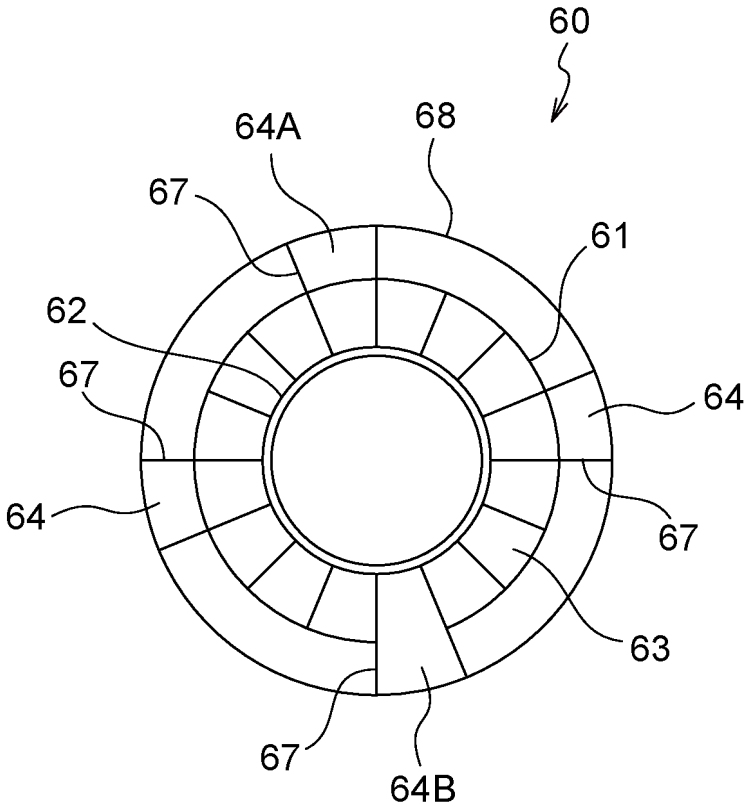


FIG.9F

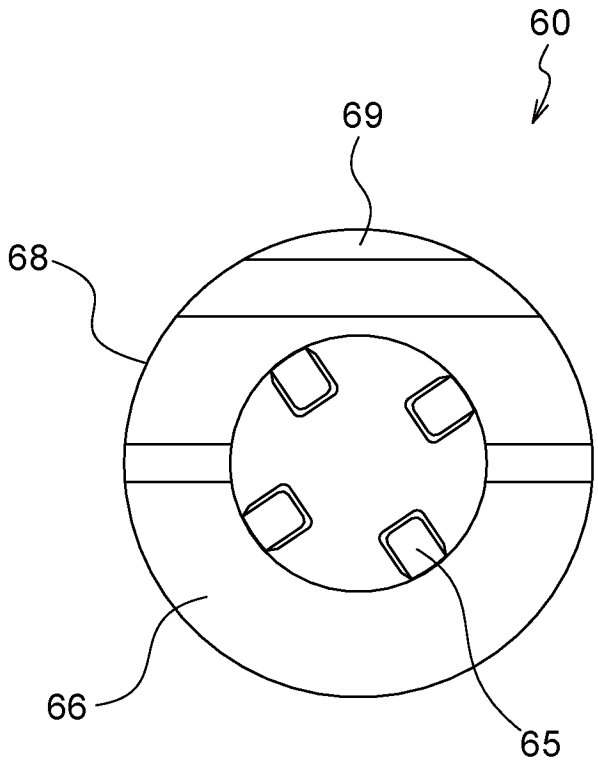


FIG.9G

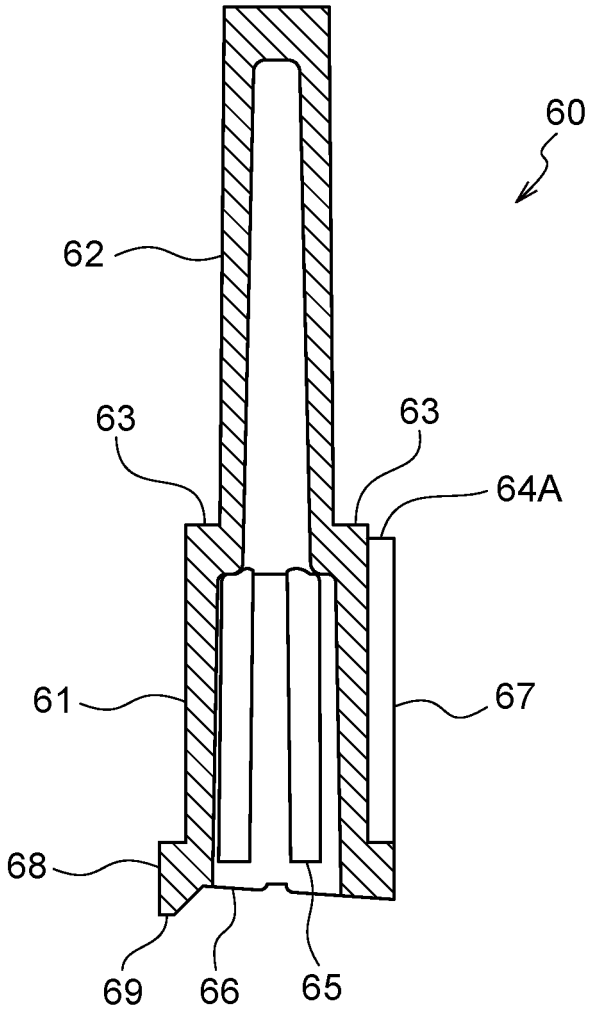


FIG.10

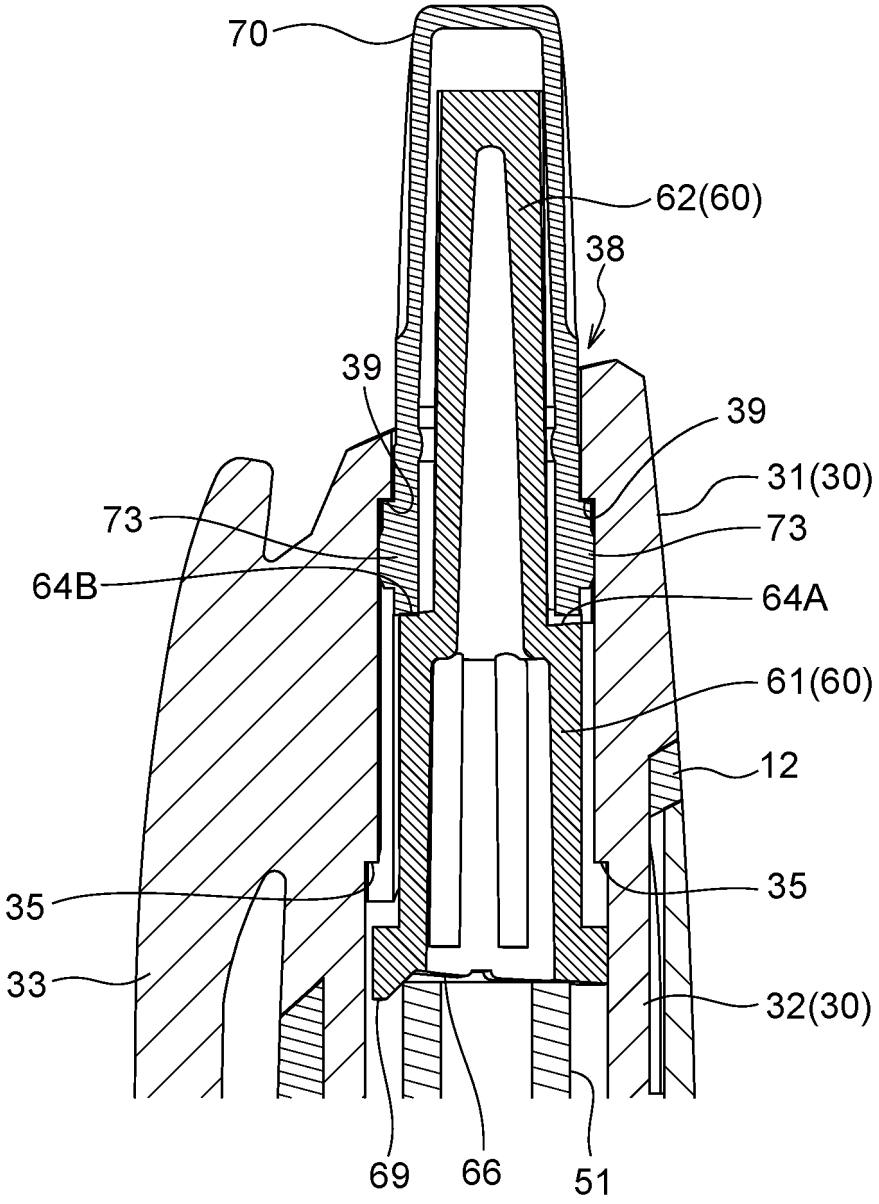


FIG.11A

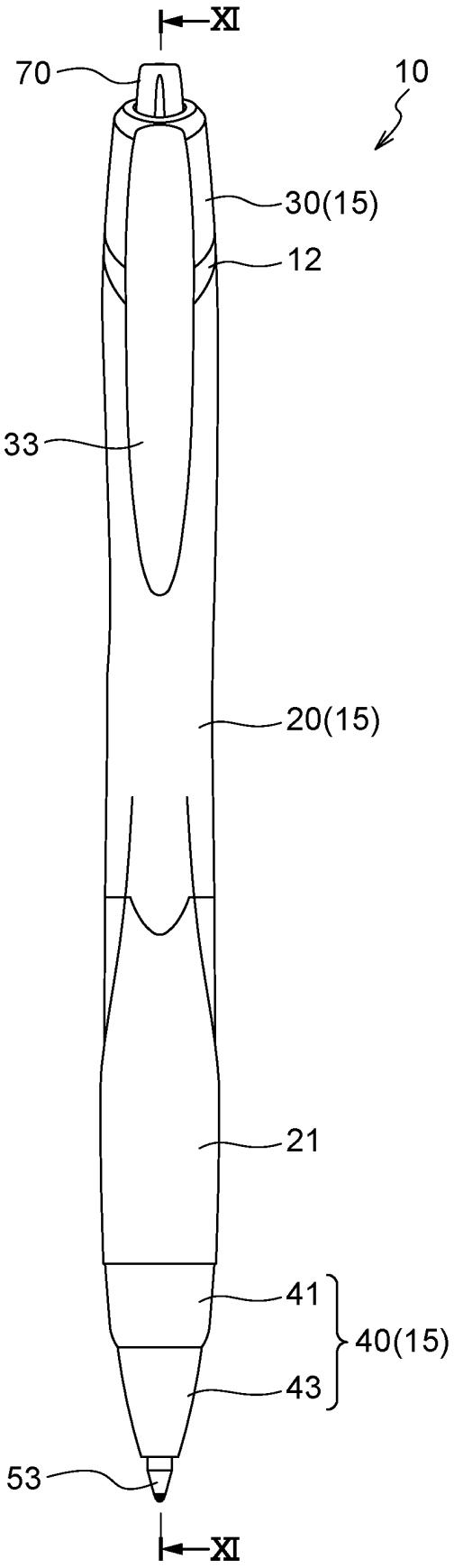


FIG.11B

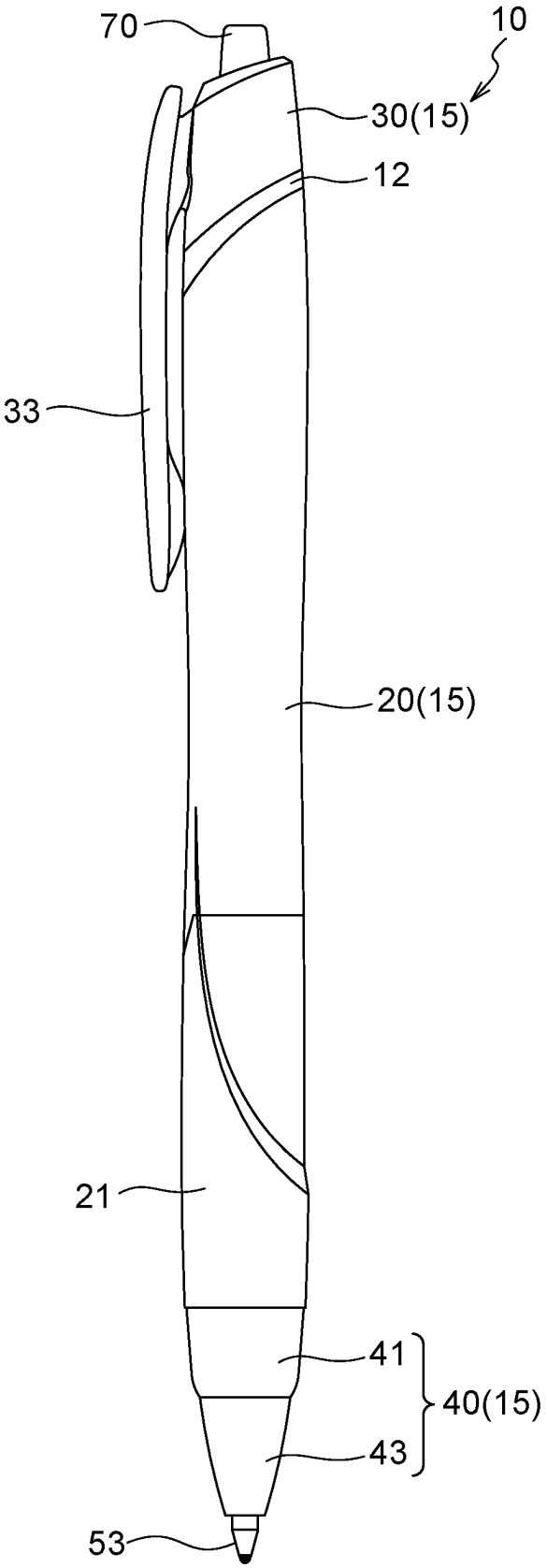
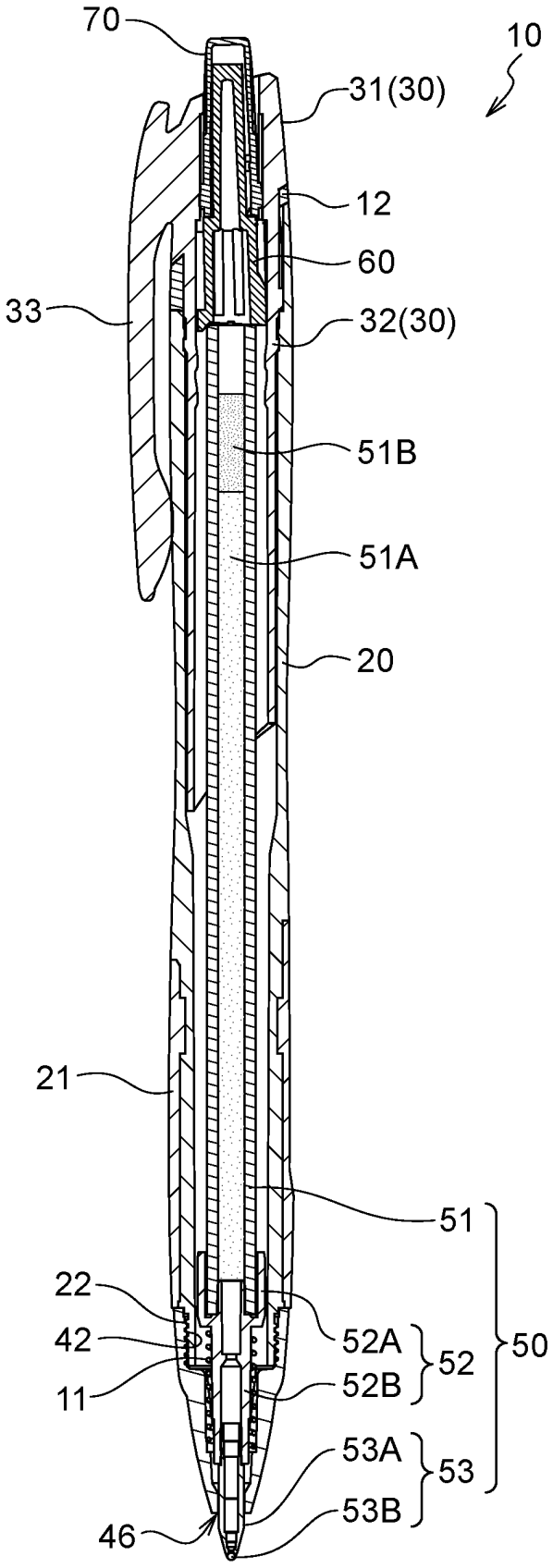


FIG.11C


70
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32(30)
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11
52B
53A
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53B
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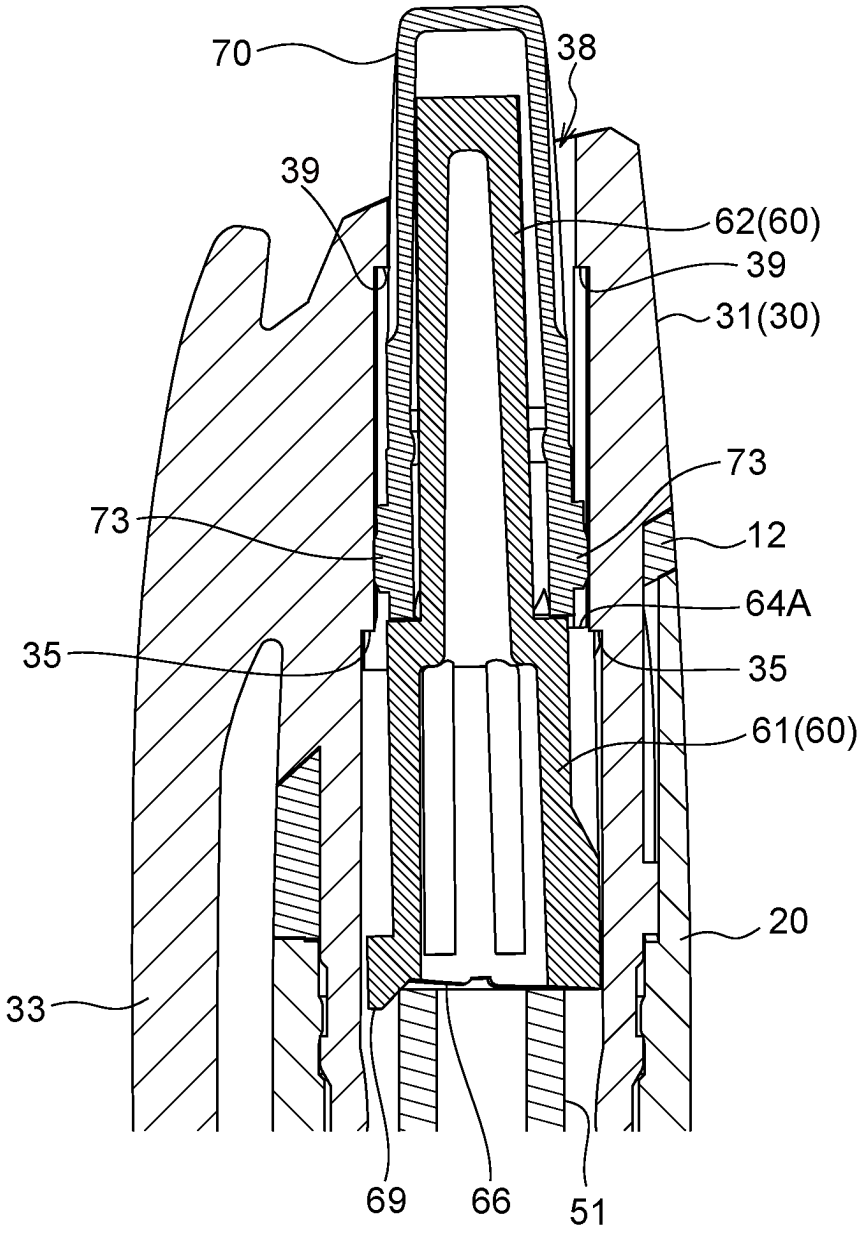
FIG.12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/030540

A. CLASSIFICATION OF SUBJECT MATTER

B43K 24/08(2006.01)i
FI: B43K24/08 150; B43K24/08 110

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)

B43K21/00-21/26, 24/00-24/18, 27/00-27/12

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2024
Registered utility model specifications of Japan 1996-2024
Published registered utility model applications of Japan 1994-2024

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2008-279672 A (PILOT CORPORATION) 20 November 2008 (2008-11-20) paragraphs [0003], [0017]-[0020], [0024], fig. 1-2, 6	1-3
A	JP 2003-305990 A (PILOT CORPORATION) 28 October 2003 (2003-10-28) paragraphs [0006], [0011]-[0016], fig. 1-3, 7	1-3
A	JP 11-78361 A (PILOT CORPORATION) 23 March 1999 (1999-03-23) paragraphs [0006], [0018], [0023], fig. 1-2, 5-6	1-3
A	DE 2507482 A1 (RIGONI, Walter) 26 August 1976 (1976-08-26) fig. 1, 5-6	1-3

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 September 2024	**22 October 2024**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2024/030540

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2008-279672 A	20 November 2008	(Family: none)	
JP 2003-305990 A	28 October 2003	(Family: none)	
JP 11-78361 A	23 March 1999	(Family: none)	
DE 2507482 A1	26 August 1976	(Family: none)	

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2023070970 A **[0002]**
- JP 2009034879 A **[0002]**
- JP 2015003443 A **[0002]**
- JP 2016037011 A **[0002]**
- JP 2016107615 A **[0002]**