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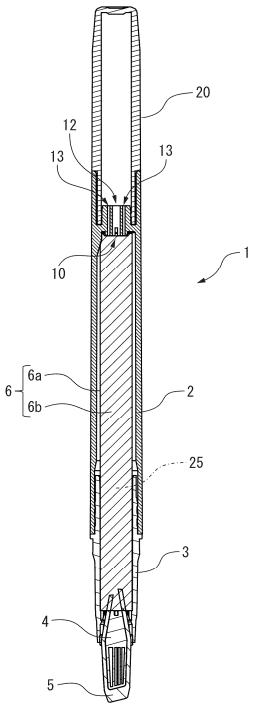
(54) WRITING INSTRUMENT AND INK STORAGE MEMBER

(57) In the present invention, a writing instrument 1 includes a shaft cylinder 2, an ink storage body 6 disposed inside the shaft cylinder 2 and impregnated with ink, an ink replenishment part 10 that is disposed behind the ink storage body 6 and that has a ventilation hole 12 and an ink discharge hole 13, and an ink storage member 20 that can be attached to a rear end part of the shaft cylinder 2 and can store ink. When the ink storage member 20 is attached to a rear end part of the shaft cylinder 2, the ink in the ink storage member 20 can be supplied to the ink storage body 6 through the ink discharge hole 13 of the ink replenishment part 10.

Fig. 2



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Description

FIELD

[0001] The present invention relates to a writing instrument and ink storage member.

BACKGROUND

[0002] Known in the art is a writing instrument having an ink reservoir arranged inside a shaft barrel and impregnated with ink and a writing core of a pen tip discharging ink guided from the ink reservoir (for example, PTL 1). As such a writing instrument, a paint marker, oil-based marker, water-based marker, underline marker, etc. may be mentioned. If the ink guided from the ink reservoir runs out due to use and writing by the writing instrument becomes no longer possible, from the viewpoint of environmental protection, it is preferable that the ink reservoir be able to be refilled with ink.

[0003] The writing instrument described in PTL 1 has a shaft barrel, an ink reservoir arranged inside of the shaft barrel, and a cap holding the pen tip. To refill ink, the cap is removed from the shaft barrel and a refilling tool in which ink is held is inserted from the front end part of shaft barrel, thereby ink can be supplied to the ink reservoir.

[CITATION LIST]

[PATENT LITERATURE]

[0004] [PTL 1] Japanese Unexamined Patent Publication No. 2019-142006

SUMMARY

[TECHNICAL PROBLEM]

[0005] In the writing instrument described in PTL 1, when taking off the cap, the pen tip may be touched and the fingers etc. may be smeared. Further, since the rear end part of the shaft barrel is closed, at the time of supply of the ink, the air inside the ink reservoir and the supplied ink are not suitably exchanged with each other and the supplied ink may overflow from the ink reservoir and in turn the shaft barrel. If slowly supplying ink from the refilling tool, the ink can be prevented from overflowing, but sometimes too much time is taken for refilling.

[0006] The present invention has as its object the provision of a writing instrument able to easily and quickly refill ink into an ink reservoir.

[SOLUTION TO PROBLEM]

[0007] According to one aspect of the present invention, there is provided a writing instrument comprising a shaft barrel, an ink reservoir arranged inside the shaft barrel and impregnated with ink, an ink refilling part arranged at the rear from the ink reservoir and having an air hole and ink discharge holes, and an ink storage member able to be attached to a rear end part of the shaft barrel and able to hold ink and, configured so that when attaching the ink storage member to a rear end part of the shaft barrel, the ink inside the ink storage member can be supplied to the ink reservoir through the ink discharge holes of the ink refilling part.

[0008] According to another aspect of the present invention, there is provided an ink storage member for a writing instrument able to be attached to a rear end part of a shaft barrel inside of which an ink refilling part having an air hole and ink discharge holes and an ink reservoir impregnated with ink are arranged, which ink storage member configured so that if attached to the rear end part of the shaft barrel, the ink can be supplied to the ink reservoir through the ink discharge holes of the ink refilling part.

[0009] The air hole may be provided further closer to a center axis of the shaft barrel than the ink discharge holes. The air hole may be provided on the center axis of the shaft barrel. The ink discharge holes may be provided concentrically cylindrically about the center axis. The ink reservoir may be configured so as to have at least two types of capillary forces.

[ADVANTAGEOUS EFFECTS OF INVENTION]

[0010] According to the aspects of the present invention, the common advantageous effect is exhibited of provision of a writing instrument able to easily and quickly refill ink into an ink reservoir.

BRIEF DESCRIPTION OF DRAWINGS

[0011]

FIG. 1 is a perspective view of a writing instrument according to an embodiment of the present invention.

FIG. 2 is a vertical cross-sectional view of the writing instrument of FIG. 1.

FIG. 3 is a disassembled perspective view of the writing instrument of FIG. 1.

FIG. 4 is a vertical cross-sectional view of an ink storage member.

FIG. 5 is another vertical cross-sectional view of the ink storage member.

FIG. 6 is an enlarged vertical cross-sectional view of a rear end part of a shaft barrel.

FIG. 7 is a horizontal cross-sectional view of an ink refilling part.

FIG. 8 is a partial cross-sectional perspective view of a shaft barrel showing the ink refilling part.

FIG. 9 is another partial cross-sectional perspective view of the shaft barrel showing the ink refilling part.

FIG. 10 is a perspective view of a core holding member.

FIG. 11 is a vertical cross-sectional view of a core holding member.

FIG. 12 is a cross-sectional view along the line D-D of FIG. 11.

DESCRIPTION OF EMBODIMENTS

[0012] Below, while referring to the drawings, an embodiment of the present invention will be explained in detail. Throughout the drawings, corresponding component elements will be assigned common reference notations.

[0013] FIG. 1 is a perspective view of a writing instrument according to an embodiment of the present invention, FIG. 2 is a vertical cross-sectional view of the writing instrument of FIG. 1, and FIG. 3 is a disassembled perspective view of the writing instrument of FIG. 1.

[0014] The writing instrument 1 has a shaft barrel 2 formed into a tubular shape, a front shaft 3 fitting inside of a front end part of the shaft barrel 2 and formed into a tubular shape, a core holding member 4 fitting inside of the front end part of the front shaft 3, a writing core 5 held by the core holding member 4, an ink reservoir 6 arranged inside the shaft barrel 2 and impregnated with ink, and an ink storage member 20 screwed inside a rear end part of the shaft barrel 2 and formed into a tubular shape. At the inside surface in the vicinity of the rear end part of the shaft barrel 2, an ink refilling part 10 is formed. Note that, the front shaft 3 may also be included and furthermore the ink storage member 20 may also be included in what is called the "shaft barrel 2".

[0015] In this Description, in the axial direction of the writing instrument 1, the writing core 5 side is prescribed as the "front", while the opposite side from the writing core 5 is prescribed as the "rear". In the explanation of the parts, the front side and the rear side are prescribed based on the state assembled as the writing instrument 1. Further, unless particularly indicated otherwise, the "center axis" means the certain axis of the writing instrument 1, that is, the shaft barrel 2.

[0016] The writing instrument 1 is a writing instrument configured so as to discharge from a writing core 5 the ink guided from an ink reservoir 6. Specifically, it is a marking pen. The writing core 5 is, for example, comprised of a sintered body, fiber bundle, foam body, sponge body, felt body, porous body, or other porous member. The writing core 5 is a substantially U-shaped member. The two end parts of the U-shape are inserted to the ink reservoir 6. The ink in the ink reservoir 6 is guided to the writing core 5 as a whole by capillary forces. Ink can be discharged at the time of writing. Note that, so long as the writing instrument 1 is a writing instrument configured to discharge ink guided from the ink reservoir 6 from the writing core 5, it may be a paint marker, an oil-based marker, a water-based marker, etc. As to the shape of the writing core 5, it may be formed into any shape in accordance with the type of the writing instrument.

[0017] If ink guided from the ink reservoir 6 runs out due to writing and the writing instrument 1 can no longer be used for writing, the ink reservoir 6 can be refilled with ink. Specifically, the ink storage member 20 can be detached from the rear end part of the shaft barrel 2 and a new ink storage member 20 in which ink is filled can be fit. The ink storage member 20 will be explained referring to FIG. 4 and FIG. 5.

[0018] FIG. 4 is a vertical cross-sectional view of the ink storage member 20, while FIG. 5 is another vertical cross-sectional view of the ink storage member 20. In FIG. 4 and FIG. 5, upward is the front side. FIG. 4 shows the ink storage member 20 in the unused state. The ink storage member 20 is closed at one end part, that is, the rear end, and can store the ink 25 inside it. The other end part of the ink storage member 20, that is, the front end, is open. The front end part of the ink storage member 20 in the unused state is fitted with a cover member 30 so that ink 25 does not leak out.

[0019] FIG. 5 shows the ink storage member 20 with the cover member 30 detached. At the front end part of the ink storage member 20, a small diameter part 21 with a diameter smaller than that at the rear part is formed. At the outer circumference of the small diameter part 21, a male screw part 22 is formed. As shown in FIG. 3, the thread of the male screw part 22 is not formed in a continuous spiral shape, but is formed as a discontinuous thread arranged on a path of a continuous spiral. That is, the thread of the male screw part 22 is formed about a center axis with exactly lengths corresponding to predetermined rotational angles and at equal intervals along the spiral direction, whereby a set of a plurality of threads aligned in the axial direction are formed at equal intervals along the circumferential direction. As shown in FIG. 5, at the inside circumference of the front end part of the ink storage member 20, an annular projection 23 formed into a ring shape is formed. Note that, as shown in the later explained FIG. 6, at the inside circumference of the rear end part of the shaft barrel 2, a female screw part 7 able to be screwed into by the male screw part 22 of the ink storage member 20 and having a similar shape is formed.

[0020] Referring to FIG. 4, at the inner side of the front end face of the cover member 30, a closing member 31 fitting with an inner circumference of a front end part of the ink storage member 20 is formed. The closing member 31 is a tubular shaped projection extending to the rear. At the outer circumference of the closing member 31, a fitting projection 32 is formed in a ring shape. At the inner circumference of the cover member 30, a female screw

part (not shown) able to be screwed into by the male screw part 22 of the ink storage member 20 is formed. When screwing together the ink storage member 20 and the cover member 30, the fitting projection 32 of the closing member 31 inserted to the inside of the ink storage member 20 and the annular projection 23 of the ink storage member 20 elastically deform along which they ride over each other completing the screwing process. As a result, the seal between the ink storage member 20 and closing member 31 is improved and leakage of ink from the ink storage member 20 is prevented. Further, by the cover member 30 being screwed with the ink storage member 20 inside of which ink is filled, the ink storage member 20 can be stored, carried around, etc. as is in the unused state.

[0021] The outer circumference of the ink storage member 20, as shown in FIG. 1 and FIG. 2, is formed so that in the state attached to the shaft barrel 2, it becomes flush with the outer circumference of the shaft barrel 2, that is, becomes integral with it. Note that, the outer circumference of the cover member 30 as well is formed so that it becomes flush with the outer circumference of the ink storage member 20, that is, becomes integral with it.

[0022] To refill the ink, the cover member 30 is detached from the unused ink storage member 20 in the state with the front end facing upward so that ink does not leak out. Next, the already attached ink storage member 20 is detached from the shaft barrel 2 and, in its place, in the state with the writing core 5 of the writing instrument 1 turned upward, an unused ink storage member 20 is screwed into the shaft barrel 2 to attach it. Next, when tilting the writing instrument 1 so that the writing core 5 faces downward, gravity causes the ink 24 inside of the ink storage member 20 to move inside the shaft barrel 2 and, further, passes through the ink refilling part 10. The ink 25 passing through the ink refilling part 10 is supplied to the ink reservoir 6 whereby the ink finishes being refilled. The ink refilling part 10 will be explained while referring to FIG. 6 to FIG. 9.

[0023] FIG. 6 is an enlarged vertical cross-sectional view of the rear end part of a shaft barrel 2. FIG. 7 is a horizontal cross-sectional view of the ink refilling part 10. Specifically, FIG. 7(A) is a cross-sectional view along the line A-A of FIG. 6, FIG. 7(B) is a cross-sectional view along the line B-B of FIG. 6, and FIG. 7(C) is a cross-sectional view along the line C-C of FIG. 6. Further, FIG. 8 is a partial cross-sectional perspective view of the shaft barrel showing the ink refilling part 10 while FIG. 9 is another partial cross-sectional perspective view of the shaft barrel showing the ink refilling part 10. Specifically, FIG. 8 and FIG. 9 are perspective views with the shaft barrel 2 cut open in the vicinity of the ink refilling part 10, FIG. 8 is a perspective view of the ink refilling part 10 seen from the rear side of the shaft barrel 2, and FIG. 9 is a perspective view of the ink refilling part 10 seen from the front side of the shaft barrel 2.

[0024] In the vicinity of the rear end part of the shaft barrel 2, a female screw part 7 able to be screwed into by the male screw part 22 of the ink storage member 20 is formed. The female screw part 7, in the same way as the male screw part 22 of the ink storage member 20, has a plurality of threads arranged in the same spiral shape and aligned in the axial direction and formed at equal intervals in the circumferential direction. As explained above, at the inside surface in the vicinity of the rear end part of the shaft barrel 2 the ink refilling part 10 is formed. The ink refilling part 10 has a partition wall 11 cutting across the inside surface of the shaft barrel 2. The partition wall 11 is provided with an air hole 12 and two ink discharge holes 13 running through the partition wall 11 in the axial direction. At the front of the partition wall 11, three ribs 8 are formed arranged at equal intervals along the circumferential direction. The ribs 8 are formed with slanted surfaces 9 facing the front. The ink reservoir 6 inserted from the front of the shaft barrel 2 to the inside is guided toward the center by the slanted surfaces 9 of the ribs 8 so that the center axes of the shaft barrel 2 and ink reservoir 6 match. Due to this, the ink reservoir 6 is fixed to the shaft barrel 2 so as to be gripped between the ribs 8.

[0025] In particular, as shown in FIG. 8, a first barrel wall 14 is formed in a tubular shape from the partition wall 11 toward the rear and a second barrel wall 15 is formed in a tubular shape so as to surround the first barrel wall 14. The center axes of the first barrel wall 14 and second barrel wall 15 match the center axis of the shaft barrel 2. Between the outer circumference of the second barrel wall 15 and the inner circumference of the shaft barrel 2, a fitting space 16 is defined. Note that, when attaching the ink storage member 20 to the shaft barrel 2, the small diameter part 21 of the ink storage member 20 is fit into the fitting space 16 and fills the fitting space 16. Due to this, when refilling ink, ink flowing into the shaft barrel 2 from the ink storage member 20 is prevented from pooling around the second barrel wall 15 and all of the ink can be made to impregnate the ink reservoir 6.

[0026] As shown in FIG. 7(B), the partition wall 11 is formed with a through hole 11a of a circular shape equal in inside diameter to the first barrel wall 14. The cylindrical air hole 12 is defined by the inside of the first barrel wall 14 and through hole 11a passing through the partition wall 11. Therefore, the air hole 12 is provided on the center axis of the shaft barrel 2 and connects the areas at the front and rear of the partition wall 11.

[0027] Further, as shown in FIG. 7(B), around the through hole 11a of the partition wall 11, two arc-shaped through holes 11b are formed corresponding to parts of the cylindrical space defined between the first barrel wall 14 and second barrel wall 15. The two through holes 11b are arranged symmetrically about the center axis. As shown in FIG. 7(C), two flattened donut-shaped abutting projections 17 are formed from the partition wall toward the front. The two abutting projections 17 are separated by a slit 18 extending in the radial direction and are arranged symmetrically about it. The diameter of the circumscribed circle of the two abutting projections 17

is formed smaller than the outside diameter of the ink reservoir 6. The two through holes 11b run through the corresponding abutting projections 17 in the axial direction. The two ink discharge holes 13 are defined by the cylindrical space defined between the first barrel wall 14 and second barrel wall 15 and the two through holes 11b running through the partition wall 11 and abutting projections 17. Therefore, the two ink discharge holes 13 are provided concentrically about the center axis of the shaft barrel 2 and connects the areas at the front and rear of the partition wall 11. In the assembled state of the writing instrument 1, the front end faces of the abutting projections 17 are completely covered by the rear end faces of the ink reservoir 6, therefore the exits of the ink discharge holes 13 abut against the ink reservoir 6.

[0028] As explained above, to refill ink, in the state with the writing core 5 of the writing instrument 1 turned upward, an unused ink storage member 20 is screwed into the shaft barrel 2 to attach it. Next, the writing instrument 1 is tilted so that the writing core 5 faces downward. As a result, the ink inside of the ink storage member 20 runs through the ink discharge holes 13 of the ink refilling part 10 due to gravity and is supplied from the rear end face of the ink reservoir 6 to the inside of the ink reservoir 6. In more detail, along with the writing instrument 1 being tilted, the ink descends along the wall surfaces of the ink storage member 20. The ink discharge holes 13 are set further away from the center axis of the shaft barrel 2 or ink storage member 20 than the air hole 12, that is, is provided at the outer side in the radial direction from the air hole 12, therefore the ink continues to descend along the ink discharge holes 13 first compared with the air hole 12. In particular, front end faces of the abutting projections 17 of the exits of the ink discharge holes 13 abut against the ink reservoir 6. Specifically, they abut against the later explained fibrous body 6b, therefore the ink passing through the ink discharge holes 13 can be directly supplied to the ink reservoir 6.

[0029] The entrance of the air hole 12, that is, the through hole 11a provided at the partition wall 11, is separated from the ink reservoir 6 by the abutting projections 17, therefore is communicated with the slit 18 between the two adjoining projections 17. The slit 18 connects with the inside of the shaft barrel 2, specifically the space between the inner circumference of the shaft barrel 2 and the outer circumference of the ink reservoir 6, so the air hole 12 communicates with the inside of the shaft barrel 2.

[0030] As explained above, if ink is supplied to the rear end face of the ink reservoir 6, the ink gradually penetrates from the rear toward the front. Along with penetration of ink, the air inside the ink reservoir 6 also gradually moves from the rear to the front and is discharged from the front end face of the ink reservoir 6. The air ejected from the front end face of the ink reservoir 6 runs through the space between the inner circumference of the shaft barrel 2 and the outer circumference of the ink reservoir 6 and flows from the air hole 12 to the ink storage member 20 side. In short, if ink is supplied through the ink discharge holes 13 to the inside of the ink reservoir 6, that volume of air inside the ink reservoir 6 runs through the air hole 12 and flows to the ink storage member 20 side. Inside the ink reservoir 6, ink can be quickly refilled since the direction of flow of ink and direction of flow of air match.

[0031] Furthermore, the ink of the writing instrument 1 is refilled by just detaching the ink storage member 20 attached to the rear end part of the writing instrument 1 and already emptied of ink and attaching an unused ink storage member 20. For this reason, like in the writing instrument described in PTL 1, there is no need to detach the cap with the pen tip as a whole, therefore fingers etc. are not liable to be smeared by the writing core 5 and there is no need to worry about overflow of ink during the refilling work. Therefore, according to the writing instrument 1, it is possible to easily and quickly refill the ink.

[0032] The horizontal cross-sectional areas of the ink discharge holes 13 are formed so as to become smaller than the horizontal cross-sectional area of the air hole 12. For this reason, even if considering the same ink running, the capillary forces of the ink discharge holes 13 with the small horizontal cross-sectional areas and fine flow paths are larger than the capillary force of the air hole 12 with the large horizontal cross-sectional areas and thick flow paths. Therefore, by the ink passing through the ink discharge holes 13, flow of ink can be promoted by the action of the capillary forces.

[0033] Due to the above, the writing instrument 1 is configured so that if attaching the ink storage member 20 to the rear end part of the shaft barrel 2, the ink for refill use in the ink storage member 20 can be supplied through the ink discharge holes 13 of the ink refilling part 10 to the ink reservoir 6. The ink refilling part 10 need only be arranged at the rear from the ink reservoir 6. Therefore, it may also be arranged not inside of the shaft barrel 2, but inside the ink storage member 20. The ink refilling part 10 may also be separately configured and may be inserted inside the shaft barrel 2 or the ink storage member 20. When tilting the writing instrument 1, so long as the air hole 12 is provided nearer to the center axis of the shaft barrel 2 than the ink discharge holes 13 so that the ink first runs through the ink discharge holes 13, the shapes, numbers, and placement of the air hole 12 and ink discharge holes 13 can be freely selected. The air hole 12 is preferably provided on the center axis, but may also be off from the center axis. The ink discharge holes 13 are preferably provided concentrically about the center axis of the shaft barrel 2, but need not be provided concentrically.

[0034] The ink supplied from the ink storage member 20 through the ink refilling part 10 to the ink reservoir 6 impregnates the ink reservoir 6 as a whole by the action of capillary forces inside the ink reservoir 6. Due to this, it becomes possible to eliminate the unevenness of discharge of ink at the time of writing and to use the ink without waste. The ink reservoir 6 preferably has at least

two types of capillary forces considering the differences in fluidity of air and ink. The ink reservoir 6 will be explained below.

[0035] As shown in FIG. 2, the ink reservoir 6 is comprised of a sheath 6a and a fibrous body 6b of a plurality of filaments arranged in the longitudinal direction. As the fibers, for example, natural fibers, animal fibers, and fibers comprised of polyacetal-based resins, acryl-based resins, polyester-based resins, etc. may be mentioned. The ink reservoir 6 is formed into a cylindrical shape as a whole by the fibrous body 6b being surrounded by the sheath 6a. At the two end parts of the ink reservoir 6, the fibrous body 6b is cut evenly. Circular end faces are formed by the exposed fibrous body 6b.

[0036] The sheath 6a is a sheet-shaped member. The sheath may be a plastic film or other material not having a capillary force or may be a nonwoven fabric or other material having a capillary force. By forming the sheath 6a by a nonwoven fabric or other porous material, at the time of refilling the ink, it is possible to discharge air from inside the ink reservoir 6 to the outside.

[0037] The fibrous body 6b is formed with innumerable flow paths for ink and air by the fine gaps between the fibers. As stated above, if ink is supplied from the ink storage member 20 to the ink reservoir 6, that is, the fibrous body 6b, ink enters the fine gaps among the fibers. The ink penetrates the insides of the fine gaps by capillary forces over the fibrous body 6b as a whole. At this time, by adjusting the density of the fibers forming the fibrous body 6b, that is, the magnitude of the gaps among fibers, it is possible to adjust the magnitude of the capillary forces and promote the penetration of ink. The density of the fibers forming the fibrous body 6b can, for example, be adjusted by the thickness of the fibers.

[0038] If the fibrous body 6b is comprised of thicker fibers and thinner fibers, the fibrous body 6b has two types of capillary forces. However, if making the fibrous body 6b out of fibers with different thicknesses, the different fibers are not mixed but the fibers of the same thicknesses are segregated together. The portions comprised of the thicker fibers have larger gaps than the portions comprised of the thinner fibers, therefore the capillary force becomes smaller. According to the ink reservoir 6 comprised of a fibrous body 6b made of fibers of two types of thickness, the supplied ink is preferentially sucked into the gaps between the finer fibers with the larger capillary force, so the gaps between the thicker fibers become the flow paths for air whereby discharge of air is promoted. The fibrous body 6b may also be comprised of fibers of three or more different types of thickness.

[0039] Experiments performed using specific examples regarding the presence or absence of the ink refilling part 10 of the writing instrument 1 and the difference of fibers forming the fibrous body 6b of the ink reservoir 6 will be explained below.

[0040] For the columnar ink reservoir 6, the outside diameter was made 6.5 mm and the total length was made 60 mm. As explained below, Examples 1 to 8 and Comparative Examples 1 and 2 were prepared. In each of Examples 1 to 8, an ink reservoir was set at a writing instrument having an ink refilling part, that is, a writing instrument having two types of flow paths of the air hole and ink discharge holes. In each of Comparative Examples 1 and 2, an ink reservoir was set at a writing instrument not having an ink refilling part, that is, a writing instrument not having a barrier between the ink storage member and ink reservoir.

<Examples>

[0041] Example 1: A fibrous body comprised of 11,000 3dtex fibers and 460 2dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

[0042] Example 2: A fibrous body comprised of 12,000 3dtex fibers and 500 2dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

[0043] Example 3: A fibrous body comprised of 10,000 3dtex fibers and 400 2dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

[0044] Example 4: A fibrous body comprised of 10,000 3dtex fibers and 50 15dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

[0045] Example 5: A fibrous body comprised of 9,000 3dtex fibers, 460 2dtex fibers, and 50 15dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

[0046] Example 6: A fibrous body comprised of 12,000 3dtex fibers wrapped around by a sheath comprised of a nonwoven fabric to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

[0047] Example 7: A fibrous body comprised of 12,000 3dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

[0048] Example 8: A fibrous body comprised of 14,000 3dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument having an ink refilling part.

<Comparative Examples>

[0049] Comparative Example 1: A fibrous body comprised of 12,000 3dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument not having an ink refilling part.

[0050] Comparative Example 2: A fibrous body com-

prised of 14,000 3dtex fibers wrapped around by a sheath comprised of a PET film to obtain an ink reservoir which is set in a writing instrument not having an ink refilling part.

<Method of Experiment>

[0051] An ink reservoir was impregnated in advance with exactly 1.7 g of ink. Writing was performed to make a 1.3 g amount of that to be discharged. Next, an unused ink storage member was attached to the shaft barrel and the ink reservoir was supplied with exactly 1.2 g of ink. The impregnation time until the supplied ink impregnated all of the inside of the ink reservoir was measured.

<Results of Experiment>

[0052] The impregnation time of the ink in each of Examples 1 to 8 was 25 seconds in Example 1, 20 seconds in Example 2, 30 seconds in Example 3, 15 seconds in Examples 4 to 6, 45 seconds in Example 7, and 40 seconds in Example 8. The impregnation time of ink in each of Examples 1 to 8 was within 1 minute. In particular, in each of Examples 1 to 6, the impregnation time of ink was an excellent one of within 30 seconds. On the other hand, regarding the impregnation time of ink in each of Comparative Examples 1 and 2, in both Comparative Examples 1 and 2, some of the ink remained without impregnation even after the elapse of 600 seconds.

[0053] Examples 7 and 8 and the corresponding Comparative Examples 1 and 2 differ only on the presence or absence of an ink refilling part, but, as explained above, there is a big difference in the impregnation times of the ink. The efficacy of the ink refilling part became clear. In more detail, inside the shaft barrel at the rear of the ink reservoir or at the inside surface of the ink storage member, the ink formed a film of a recessed shape due to surface tension. If in this state the writing instrument was tilted to make the ink move forward, in Comparative Examples 1 and 2 not having the ink refilling part, the ink and the ink reservoir did not suitably contact and, therefore, it was difficult for the ink to suitably penetrate into the ink reservoir. On the other hand, in each of Examples 1 to 8 having the ink refilling part 10, when the entrance of the ink discharge holes 13 touched the surface of the ink, due to the action of the capillary forces, the ink was sucked inside of the ink discharge holes 13. As a result, the ink was discharged from the exits of the ink discharge holes 13 and was successively efficiently supplied to the ink reservoir 6.

[0054] In each of Examples 4 to 6, the impregnation time of the ink was the shortest 15 seconds. The reason was as follows: That is, the ink reservoirs of Examples 4 and 5 contained 15dtex fibers thicker than the other examples. The gaps between fibers became larger than other fibers. For this reason, inside of one ink reservoir, there were two types of capillary forces: a stronger capillary force due to the narrower gap between the 3dtex fibers, etc. and a weaker capillary force due to the broader gap between the 15dtex fibers. Due to this, the supplied ink was made to flow and the exhausted air was made to flow more efficiently. In Example 6, the sheath was made of nonwoven fabric, therefore when refilling ink, it was possible to make air be exhausted well from inside the ink reservoir 6 to outside it, whereby the supplied ink was made to flow and the exhausted air was made to flow more efficiently. The ink reservoirs of Examples 1 to 3 contained 2dtex fibers and 3dtex fibers, but did not contain 15dtex fibers. For this reason, the impregnation times of ink were longer than the ink reservoirs of Examples 4 and 5 containing 15dtex fibers, but the supplied ink was made to flow and the exhausted air was made to flow more efficiently.

[0055] From the above, the ink reservoir is preferably configured to have at least two types of capillary forces. The "two types of capillary forces" may be capillary forces obtained due to differences in the fibers forming the fibrous body. The effect obtained from the material of the sheath, for example, the nonwoven fabric, may also be called a "capillary force". That is, the fibrous body may also have two or more types of capillary forces by including one type of fiber and forming the sheath by a nonwoven fabric or other material.

[0056] Note that, as explained above, the effect of the ink refilling part is obtained regardless of the configuration of the ink reservoir, therefore the ink reservoir may also be comprised of not a fibrous body made of fibers, but a sponge, plastic particles, sintered bodies, and other porous bodies.

[0057] FIG. 10 is a perspective view of a core holding member 4, FIG. 11 is a vertical cross-sectional view of a core holding member 4, and FIG. 12 is a cross-sectional view along the line D-D of FIG. 11. The core holding member 4 has a main body part 40 formed into a trapezoidal flat shape, a fitting part 41 provided at the rear of the main body part 40 and configured to fit inside of a front end part of the front shaft 3, a holding groove 42 provided at an outer circumference of the main body part 40 and fitting part 41 and configured so that a substantially U-shaped writing core 5 fits with it, and a visible part 43 provided at a side surface of the main body part 40.

[0058] The visible part 43 is comprised of a through hole 44 provided in the main body part 40 and three beam members 45 extending inside of the through hole 44 along a longitudinal direction of the core holding member 4. Each of the beam members 45, as shown in FIG. 12, has a rectangular horizontal cross-section having substantially the same widths and heights.

[0059] By the beam members 45 being provided inside the through hole 44, excessive flexing of the core holding member 4 due to writing pressure at the time of writing is prevented. In other words, it is possible to adjust the number and the shapes, width dimensions, etc. of the beam members 45 to adjust the flexibility of the core holding member 4. Further, when writing by a writing instrument 1 comprised of a marking pen, a user can

visually confirm the visible part 43, in particular the letters written in the writing direction, through the through hole 44. The beam members 45 are provided so as to extend in the longitudinal direction of the through hole 44, but may also be provided so as to extend in a slanted direction or a short direction rotated 90 degrees.

[0060] Further, the core holding member 4 preferably is a plastic material with a compression set at 120°C of less than 80% and with a Shore A hardness of 60 to 95. Specifically, it is a styrene-based elastomer selected from the group comprising styrene-ethylene-propylene-styrene with styrene replaced by p-methylstyrene (SEPS), styrene-ethylene-ethylene-propylene-styrene with styrene replaced by p-methylstyrene (SEEPS) and styrene-ethylene-butadiene-styrene with styrene replaced by p-methylstyrene (SEBS). By using a styrene-based elastomer for the core holding member 4, it is possible to obtain a suitable elasticity at the time of writing and possible to prevent excessive writing load from damaging the writing core 5.

[REFERENCE SIGNS LIST]

[0061]

1 writing instrument
2 shaft barrel
3 front shaft
4 core holding member
5 writing core
6 ink reservoir
10 ink refilling part
11 partition wall
12 air hole
13 ink discharge holes
14 first barrel wall
15 second barrel wall
16 fitting space
17 abutting projection
18 slit
20 ink storage member
21 small diameter part
22 male screw part
23 annular projection
25 ink

Claims

1. A writing instrument comprising a shaft barrel, an ink reservoir arranged inside the shaft barrel and impregnated with ink, an ink refilling part arranged at the rear from the ink reservoir and having an air hole and ink discharge holes, and an ink storage member able to be attached to a rear end part of the shaft barrel and able to hold ink and,
configured so that when attaching the ink storage member to a rear end part of the shaft barrel, the ink inside the ink storage member can be supplied to the ink reservoir through the ink discharge holes of the ink refilling part.

2. The writing instrument according to claim 1, wherein the air hole is provided on a center axis of the shaft barrel than the ink discharge holes and the ink discharge holes are provided concentrically cylindrically about the center axis.

3. An ink storage member for a writing instrument able to be attached to a rear end part of a shaft barrel inside of which an ink refilling part having an air hole and ink discharge holes and an ink reservoir impregnated with ink are arranged,
which ink storage member configured so that if attached to the rear end part of the shaft barrel, the ink can be supplied to the ink reservoir through the ink discharge holes of the ink refilling part.

Fig. 1

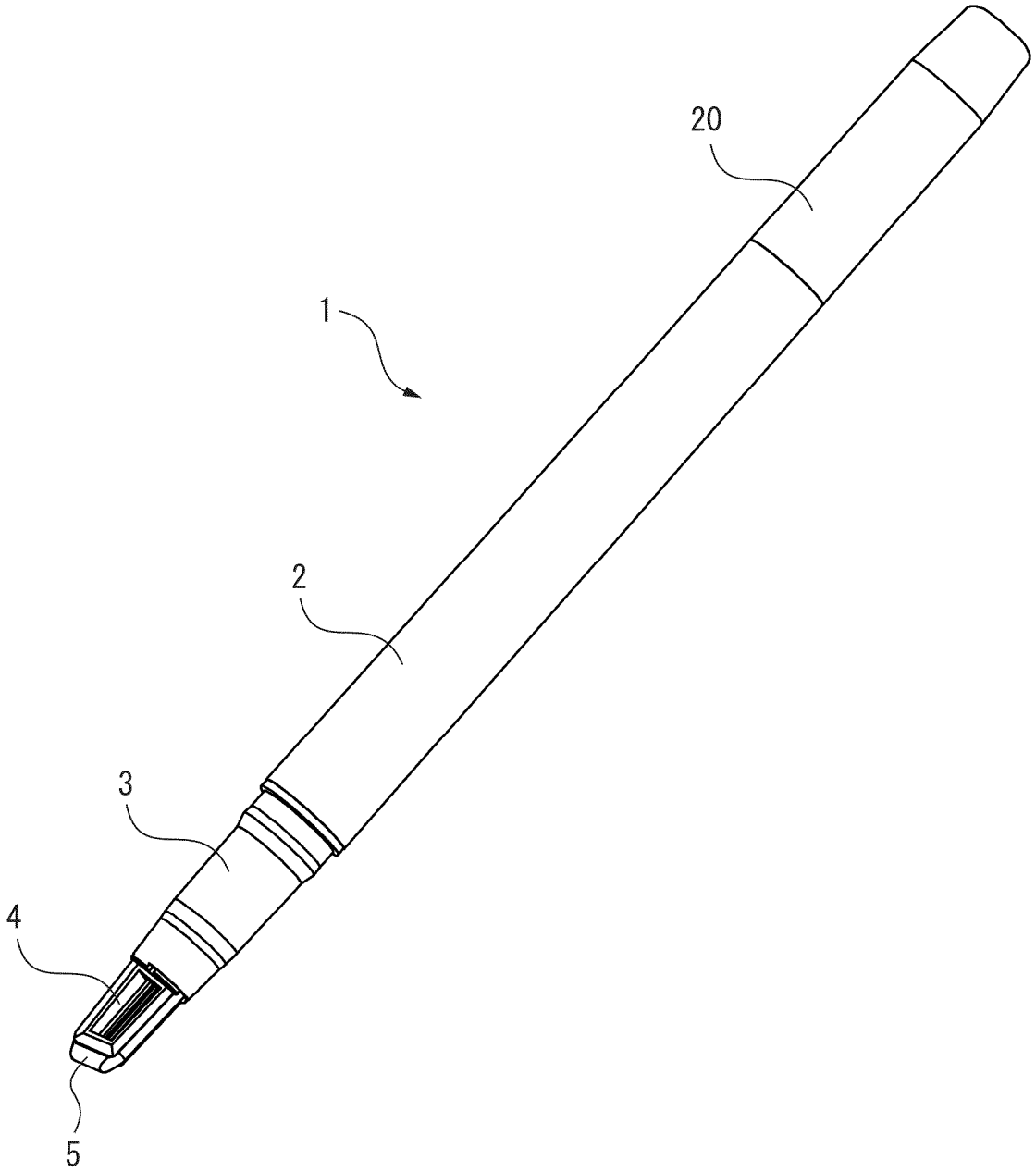


Fig. 2

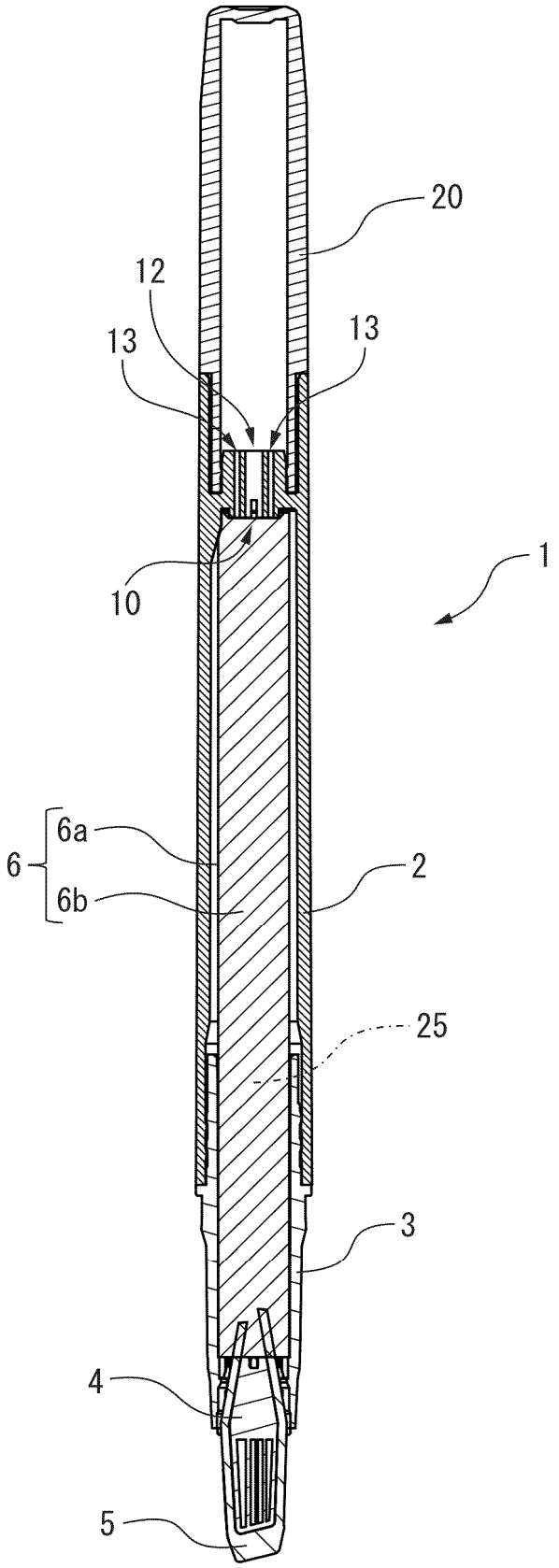


Fig. 3

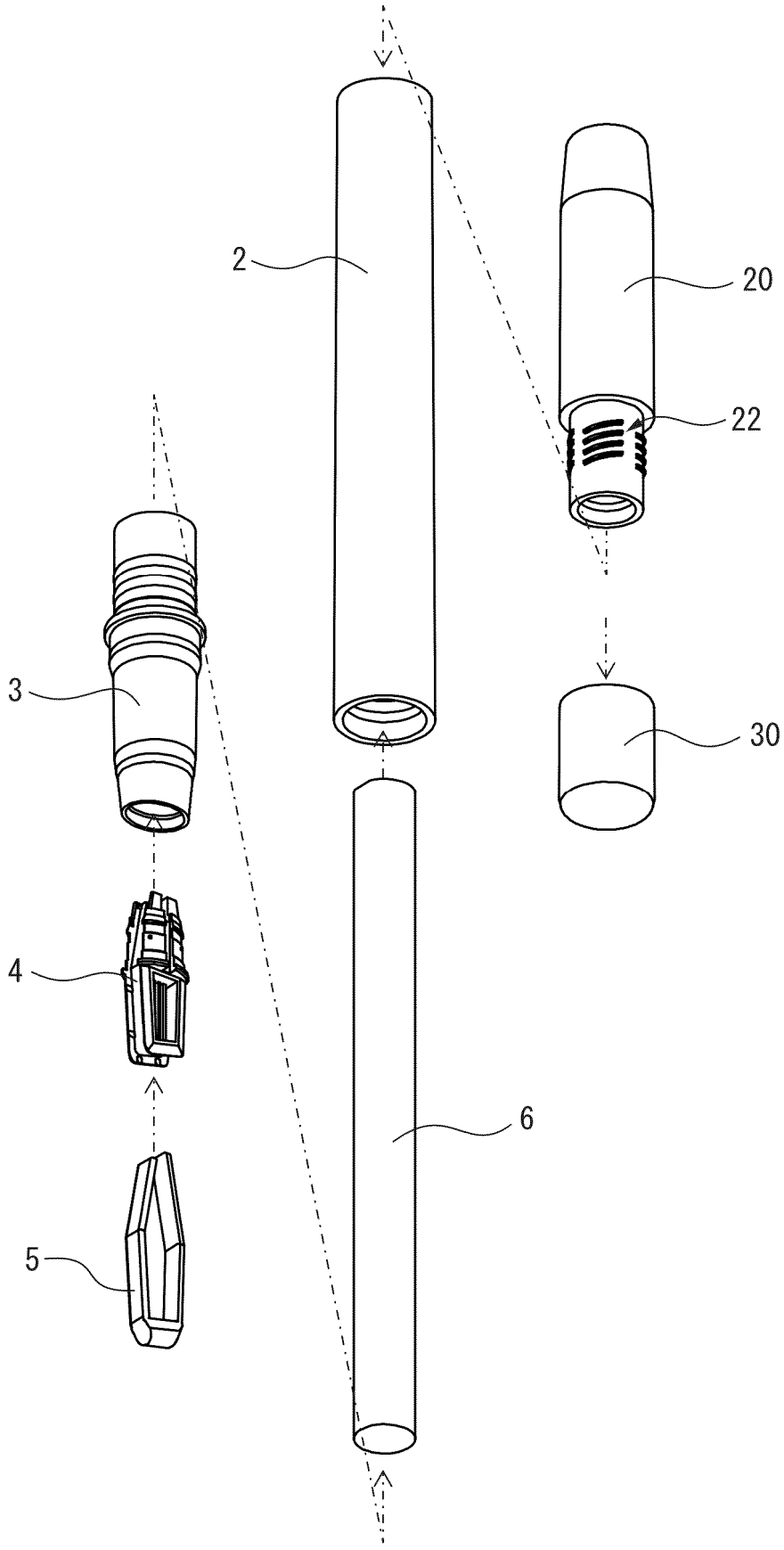


Fig. 4

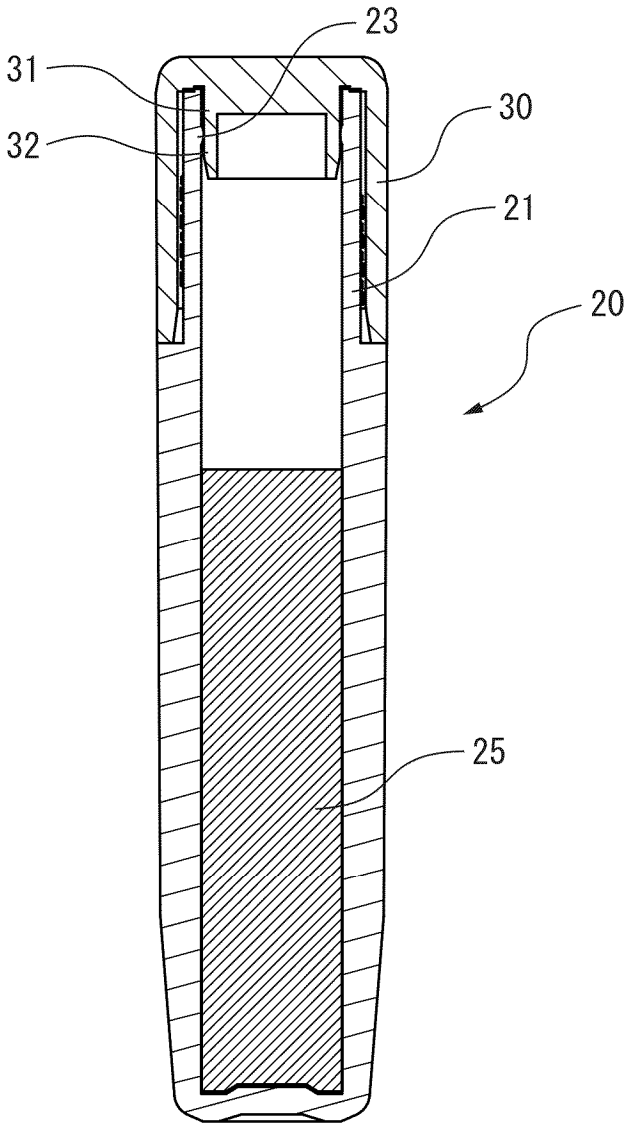


Fig. 5

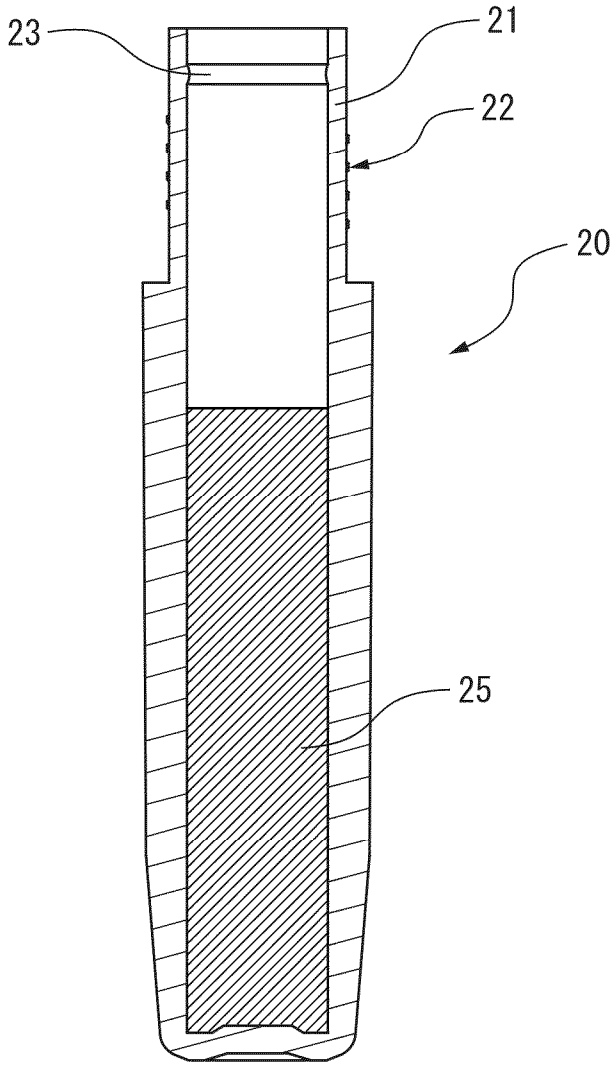


Fig. 6

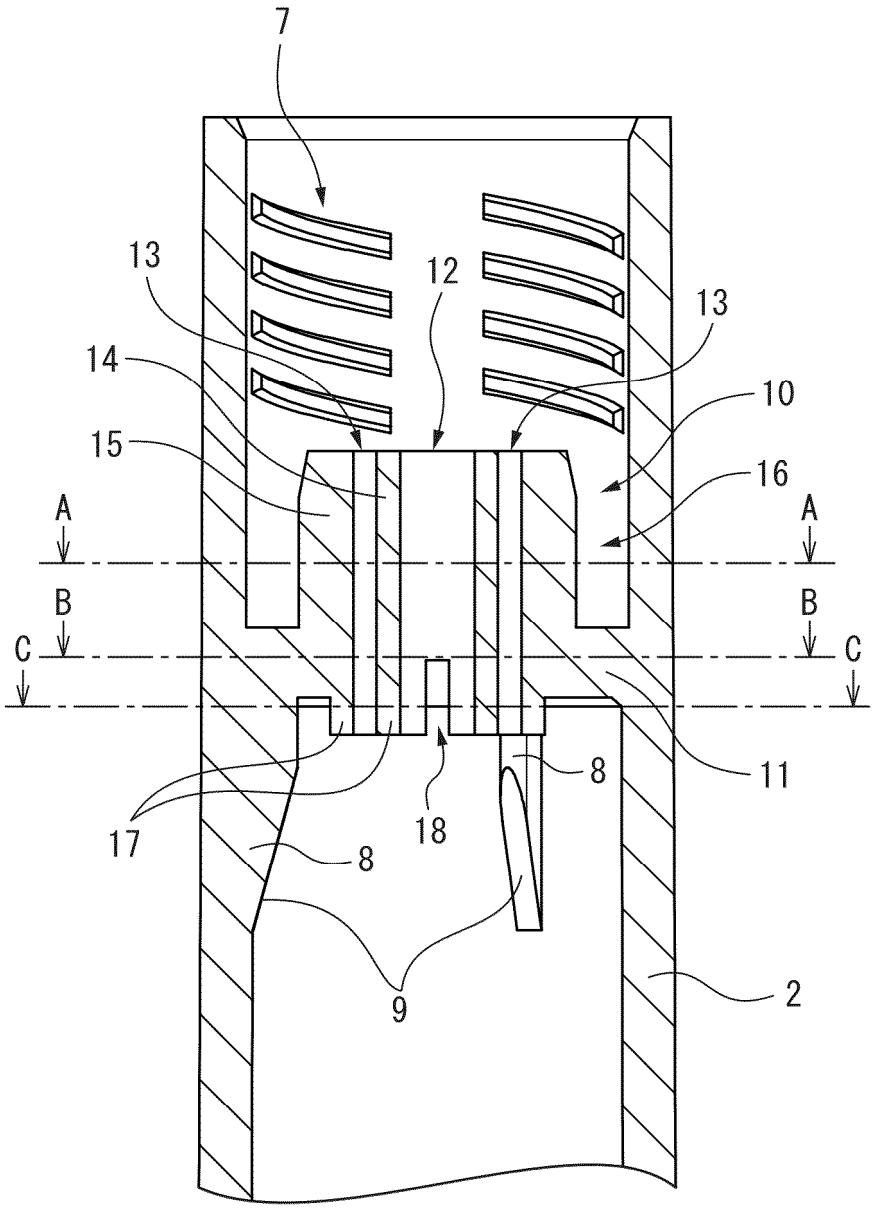


Fig. 7A

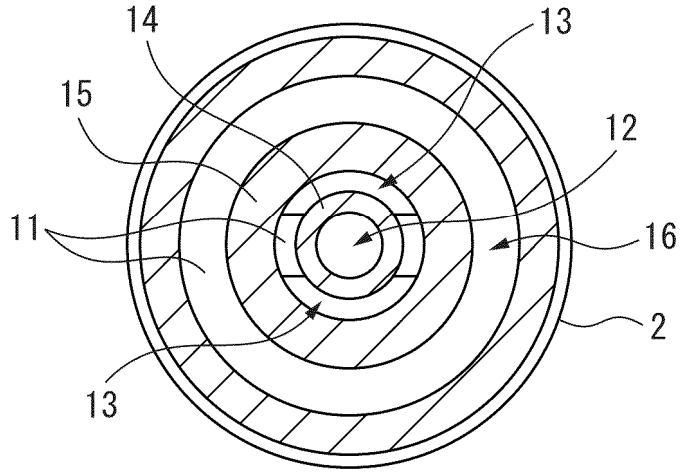


Fig. 7B

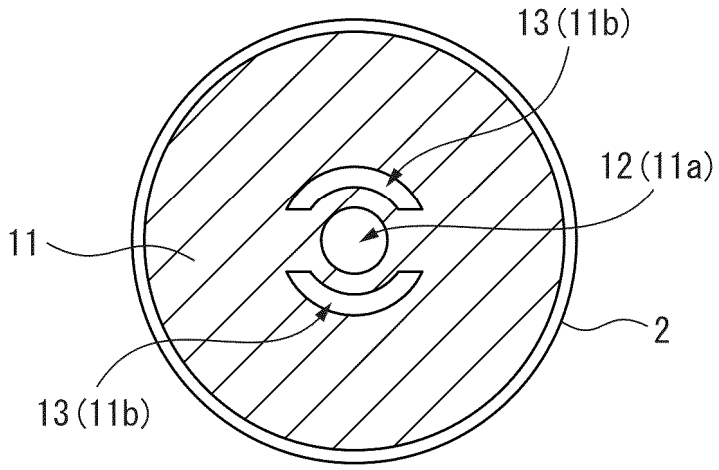


Fig. 7C

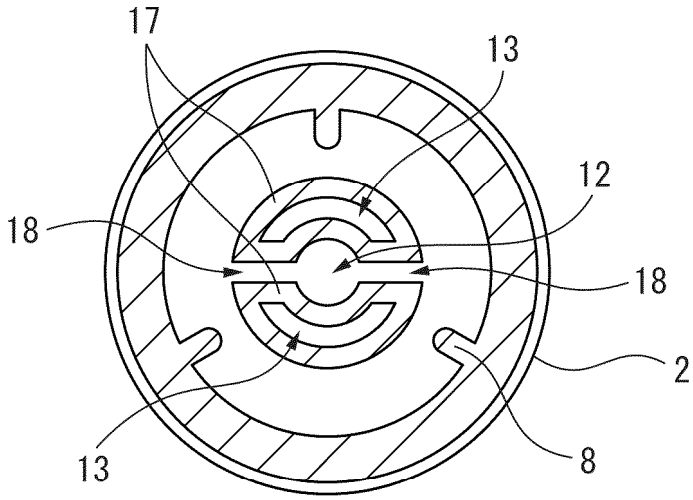


Fig. 8

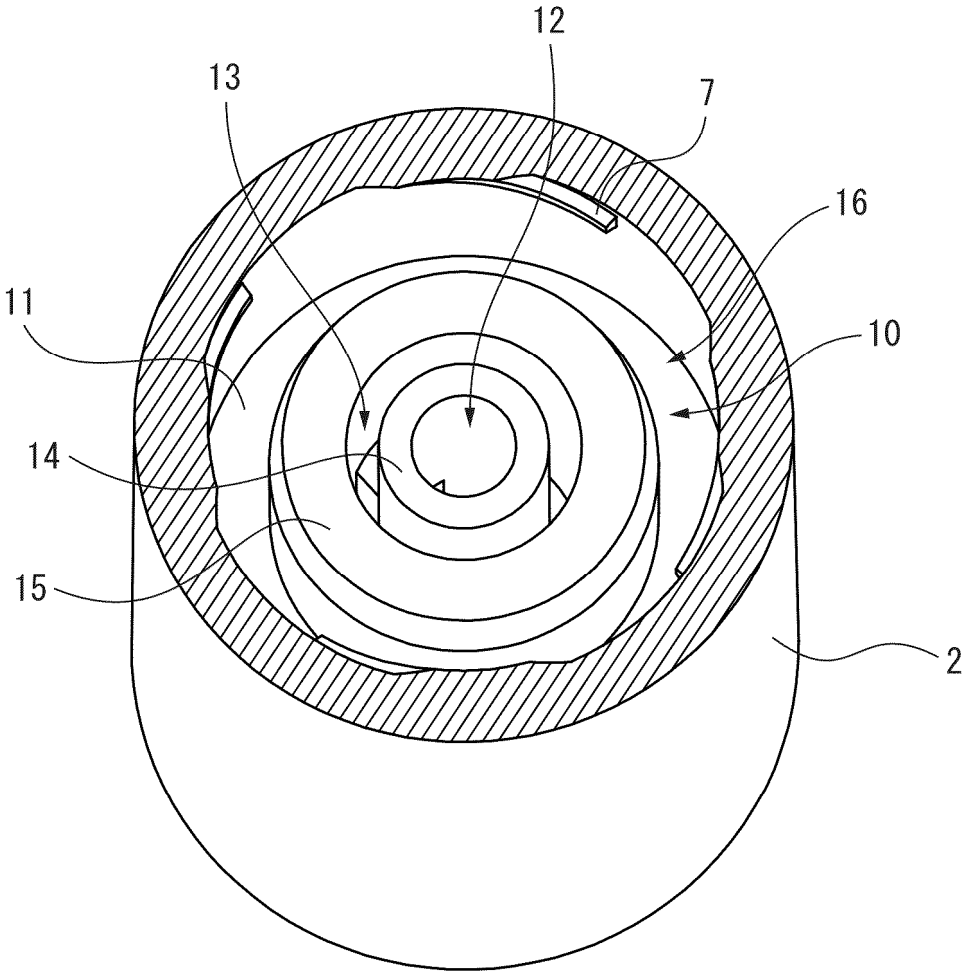


Fig. 9

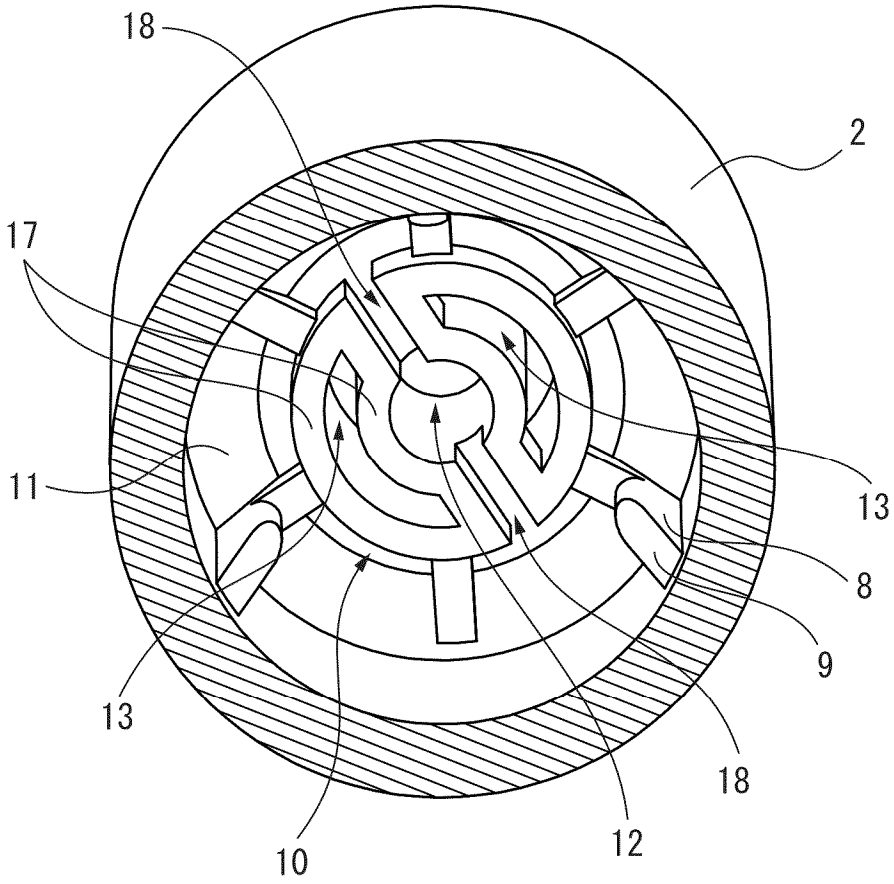


Fig. 10

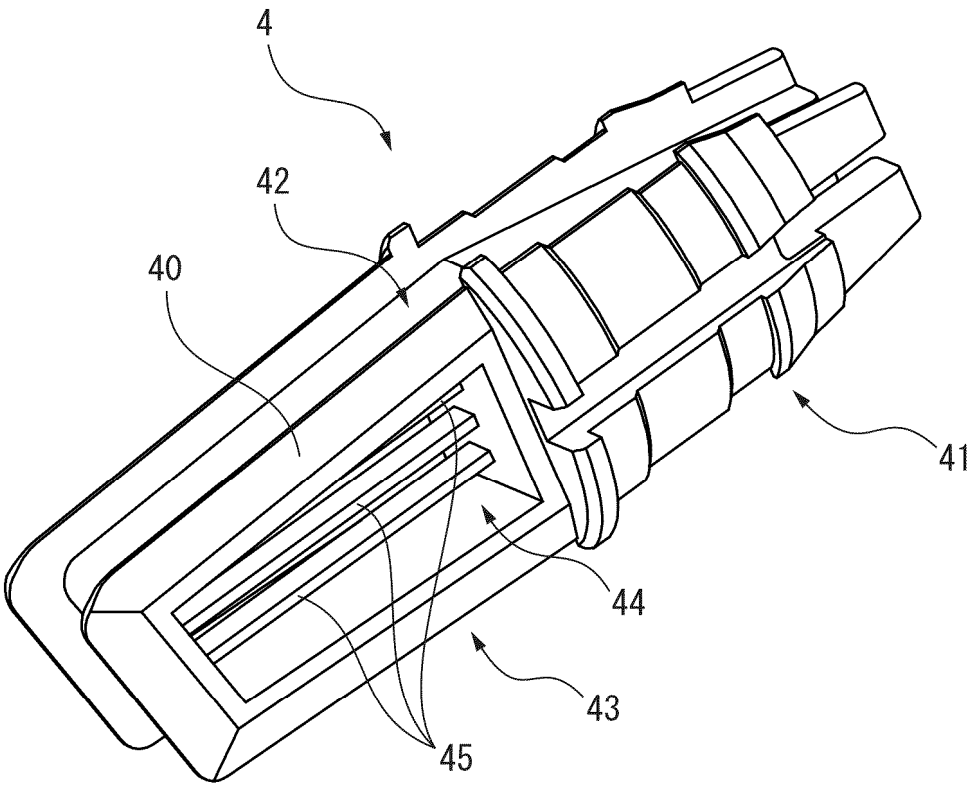


Fig. 11

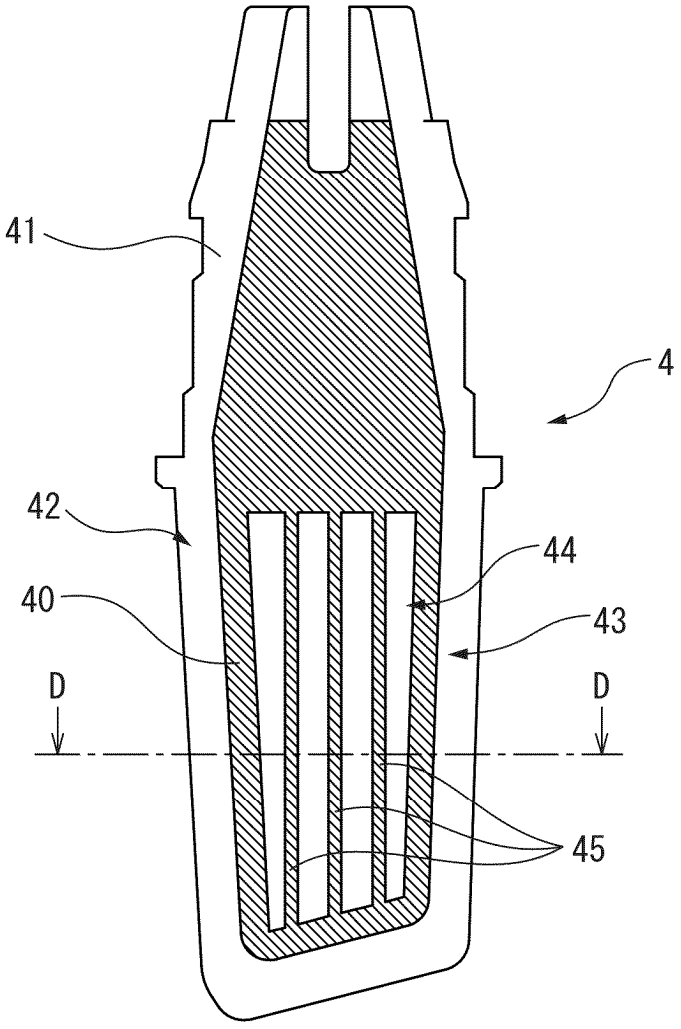
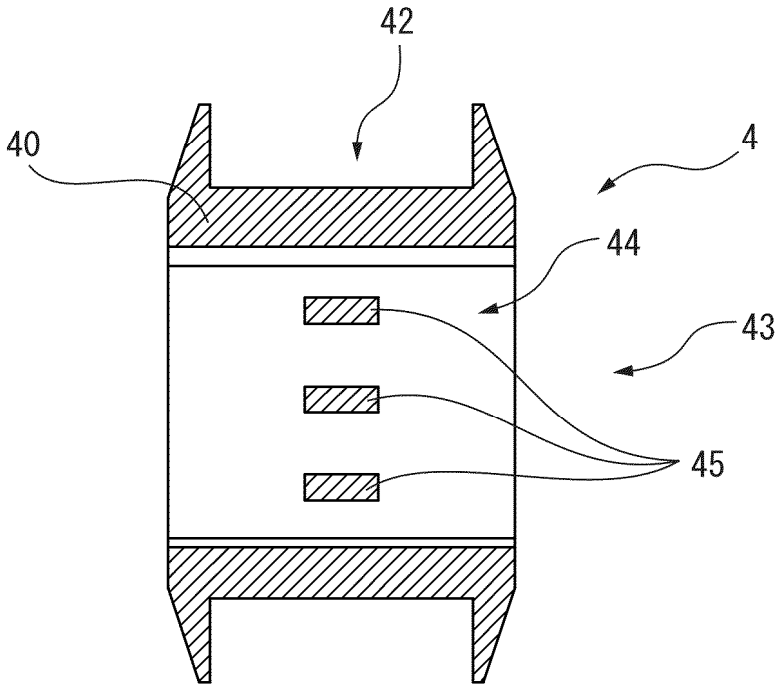


Fig. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/024052

A. CLASSIFICATION OF SUBJECT MATTER

B43K 8/03(2006.01)i; ***B43K 3/00***(2006.01)i; ***B43K 8/02***(2006.01)i
FI: B43K8/03 100; B43K3/00 L; B43K8/02 100; B43K8/02 110; B43K8/02 120; B43K8/03

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)

B43K8/03; B43K3/00; B43K8/02

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.
X	WO 2014/148445 A1 (PILOT CORPORATION) 25 September 2014 (2014-09-25) paragraphs [0019]-[0020], [0028], [0035], fig. 1, 3, 9-10	1-3
X	JP 2008-183896 A (PILOT INK CO., LTD.) 14 August 2008 (2008-08-14) paragraphs [0019], [0094], [0109]-[0110], fig. 1, 10-11	1-3
A	US 2015/0063894 A1 (MICROPOROUS TECHNOLOGY LIMITED) 05 March 2015 (2015-03-05) entire text, all drawings	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
20 August 2024	**03 September 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/JP2024/024052

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WO 2014/148445 A1	25 September 2014	US 2016/0288561 A1 paragraphs [0065]-[0066], [0083], [0099], fig. 1, 3, 9-10 JP 14-148445 A1 EP 2977224 A1 CN 105050827 A	
JP 2008-183896 A	14 August 2008	US 2007/0212159 A1 paragraphs [0094], [0288], [0358], fig. 1, 9, 13, 24 EP 1832442 A1 KR 10-2007-0092611 A TW 200800648 A	
US 2015/0063894 A1	05 March 2015	WO 2015/032143 A1 CN 103465684 A	

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REFERENCES CITED IN THE DESCRIPTION

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