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(54) A ball-point pen.

(57) A ball-point pen pertinent to use of ink having shear viscosity decreasing property has a joint (2). The joint (2) includes a valve chamber (12) which is disposed in an approximately middle portion of the joint with respect to the axial direction thereof for holding a ball (14) therein with play and has a ball seat (13) in the rear part thereof, a tip fitting hole (10) in front of the valve chamber and a conduit communicating with an ink reservoir. In this arrangement, in order to allow the ball to fit on the ball seat (13) to prevent ink from flowing backward when the ball-point pen is oriented upward and in order to surely establish an ink flow when oriented downward, the joint portion is constructed such that:

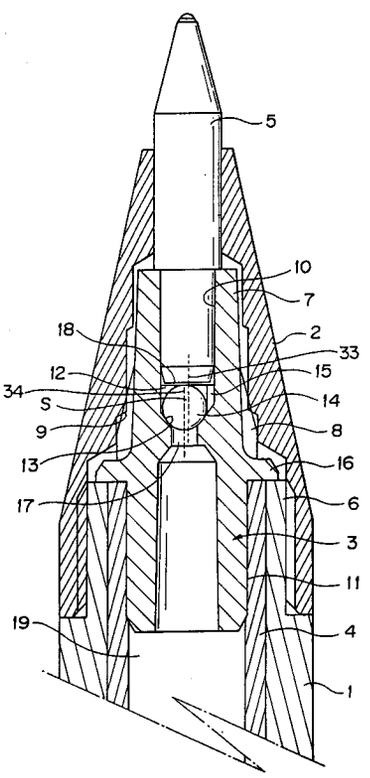
the axis of the ball seat is made eccentric to the axis of the tip end hole and a channel is provided on one side of the valve chamber space;

vertical ribs (15a) having different heights are provided in the valve chamber such that the axis of a cylindrical space defined by top surfaces of the ribs is made eccentric to the tip axis, without the axis of the ball seat made eccentric to the axis of the tip end hole;

an edge portion defined by the tip rear hole is provided with a recess; or

the tip rear end is cut obliquely with respect to the axial direction of the ball-point pen to form a slanted cut end.

FIG.2



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The present invention relates to an improved ball-point pen equipped with a back leaking preventing mechanism and in particular to an improved ball-point pen which uses a so-called thixotropic ink (having shear viscosity decreasing property) which has a relatively low ink viscosity as compared to the ink used for oil type ball-point pens and therefore is subject to flow backward and which presents high viscosity at static state but lowers its viscosity due to the rolling of a ball at writing to flow out.

The present applicant has disclosed a back leaking preventing mechanism in Japanese Utility Model Publication Hei 4 No.52067 in which prevention of back leaking of ink is effected by providing a valve chamber having a ball valve put therein with play.

This disclosure provides a plastic mouthpiece made of a synthetic resin, which holds a ball in a valve chamber thereof and which is provided with a required number of projected bars so that the ball is put therein with play and cannot slip out. At writing, ink flows to the tip through channels formed between the projected bars.

The plastic mouthpieces is formed by injection-molding. In the molding, the projected bars are formed as undercut, so that it is hard to form them with high dimensional accuracy. Further, a troublesome treatment is needed to allow the projected bars not to be damaged when the ball is inserted into the chamber by pushing away the projected bars.

Moreover, this method suffers from another drawback which arises when centrifugal treatment is effected at manufacturing stage in order to remove bubbles mingled in the ink filled. More specifically, when the centrifugal operation is performed, the ball is pushed toward the projected bar area by the centrifugal force so that the ball is bitten and fixed by the projected bars.

Conventionally known ball-point pens can be categorized into two types, one of which is a so-called oil type ball-point pen that uses a high viscosity ink. The other is a so-called water type ball-point pen which includes silver fibers holding ink therein and an ink feeder that leads ink from the fibers to the tip of the ball-point pen.

Each type of the ball-point pens has several defects, but the most notable defects with regard to the oil type ball-point pen are ink-blobbing due to the high viscosity of the ink used and low writing density.

In contrast, the water type ball-point pen takes a higher cost for materials used since the water type ball-point pen uses silver fibers for keeping the ink. Additionally, the water type ball-point pen has a drawback that consumption of ink cannot be known.

Under these circumstances, in order to solve the defects for each, there has been presented a ball-point pen which uses a thixotropic ink (having shear viscosity decreasing property) that has high viscosity at static state but lowers its viscosity at writing due to the rolling of the ball so as to allow easy flow-out of ink.

However, with regard to the ball-point pen using such a thixotropic ink, the ink is volatile or easy to vaporize and the ball-point pen is adapted such that a large amount of ink flows out in order to enhance the written density. Accordingly, the ink reservoir is made large in diameter so that it can keep a large amount of ink. In addition, since the viscosity of the ink is small as compared to those for oil-type ball-point pens, the flow resistance of the ink in question to the ink reservoir is small. As a result of these facts, the ink is liable to leak backward to the rear end of the ink reservoir due to self-weight of the ink and impacts from the outside. There is also another problem that the tip ball is subject to slip out due to falling impacts.

To deal with these drawbacks, the ball-point pens of this type are generally provided at the rear end of the ink in the reservoir with a greasy follower which moves following the consumption of ink during writing and prevents the vaporization of ink as well as inhibits the back leaking of ink which would be brought about by the self-weight of ink or the outside impact.

Even with the provision of the follower, if the ink immediately under the tip ball is used up when the writing is performed with the pen body downside up, the head or pressure of the ink is applied directly thus causing notable back leaking of ink.

In addition, when the ink reservoir is made large in inner diameter and in length so as to increase the reserve amount of ink, it becomes difficult to regulate the backflow effect caused by impacts. Once ink leaks backward, the ink not only pollutes the barrel inside but also leaks out through the vent disposed in the barrel to soil hands and clothes of the user. It is true that oil type ball-point pens also suffer from the backflow effect of ink but the effect occurs more apparent in the case of the ball-point pens using ink having thixotropic property.

Typical ball-point pens are suffering from bad write-feeling with writing since there is a gap between the tip opening of the mouthpiece and the tip and therefore the tip rattles or sways.

With regard to the aforementioned follower, in order to achieve a further improvement in safety, Japanese Utility Application Laid-Open Sho 49 No.30035 discloses a follower with a cup-shaped float immersed therein. By the way a typical follower not only effects the aforementioned function but also serves to inform the user of the finish or

exhaustion of ink. Therefore, it is naturally considered that the follower is to be colored. However, if a dye used is compatible with or soluble in the ink, it becomes difficult to keep a clear separation from the ink end. To make matters worse, the follower might flow into the tip portion, causing deterioration of writing performances.

A typical ball-point pen using a thixotropic ink employs a cap having a resilient, non-absorptive sealing piece made of a closed air-foam material, and when the pen is out of use, the tip ball is pressed against the sealing piece. In general, the front barrel end of the pen is covered with the resin cap so as to hermetically seal the tip end. In this while, if the cap has no ventilating means, pressure inside the cap could be heightened upon fitting the cap. Part of the pressurized air is forced into the ink through slight clearance between the ball and the tip holding the ball. The thus flowed-in air is left or accumulated as air bubbles in the ink due to the blockade of the follower and the air bubbles disadvantageously inhibit the ink from smoothly flowing at writing. To deal with this, ventilating means is provided between the pen tip and the cap to prevent the above effect, but this gives rise to adverse influence with regard to vaporization of the ink.

It is therefore a first object of the present invention to provide to an improved ball-point pen which is equipped with a back leaking preventing mechanism for preventing the ink backflow caused when the ball-point pen is used with the pen downside up or when the pen is shocked, and which is free from the defects or inconveniences of the conventional back leaking prevent mechanism and in which slipping out of the tip ball due to falling impacts is surely prevented.

A second object of the present invention is to provide a ball-point pen in which shaking or swaying movement of the tip is prevented even if there is a clearance between the tip opening of the mouthpiece and the tip, so as to achieve a good feeling with writing.

A third object of the present invention is to provide an improvement of a ball-point pen using a so-called thixotropic ink (having shear viscosity decreasing property) which presents high viscosity at static state but lowers its viscosity due to the rolling of a ball at writing to provide easy ink flow to thereby provide a ball-point pen having an increased ink reserve by making an ink reservoir greater in its inside diameter and/or in its length so as to lengthen the life of the pen.

A fourth object of the present invention is to provide a ball-point pen with a refill which, upon manufacture of refills of ball-point pens wherein the refills having been filled up with ink and an ink follower are bundled and undergo the centrifugal operation so as to remove air bubbles mingled in the ink, allows the ink to be defoamed in such an assured manner that the bundle of all the refills may be abutted at their tip ends against an abutting surface inside a container of a centrifugal separator.

A fifth object of the present invention is to provide a ball-point pen capable of clearly informing the exhausted state of ink without deteriorating writing performances.

A sixth object of the present invention is to provide a ball-point pen which can regulate elevation of the pressure inside the pen when a cap is attached so as not to prevent air from flowing into the ink and which can prevent the vaporization of ink by simple means.

A seventh object of the present invention is to provide a ball-point pen which allows air to pass through a pen cap so that it could prevent hazards such as choking in case an infant accidentally swallowed the cap and the cap stuck into its throat.

(1) A ball-point pen equipped with a back leaking preventing mechanism comprises:

a joint comprising:

a valve chamber disposed in an approximately middle portion of the joint with respect to the axial direction thereof for holding a ball valve therein with play, the valve chamber further having a ball valve seat in the rear part thereof;

a tip fitting hole disposed in front of the valve chamber; and

a conduit disposed in the rear of the valve chamber and communicating therewith either in the radially central portion or in a portion offset from the radial center of the ball valve seat,

wherein the joint holds a tip by the tip fitting hole and holding an ink reservoir communicating with the conduit; and

means which allows the ball valve to fit on the ball valve seat so as to stop up the conduit when the tip fitting hole is oriented upward and which allows the ball valve to be spaced from a wall surface of the valve chamber and be held so as not to stop up the end hole of the tip fit into the tip fitting hole when the tip fitting hole is oriented downward.

(2) In a ball-point pen as written in (1), the means which allows the ball valve to be spaced from a wall surface of the valve chamber and be held so as not to stop up the end hole of the tip is constructed such that the axis of the ball valve seat is made eccentric relative to the axis of the tip end hole and that a channel is provided on one side of the valve chamber space.

(3) In a ball-point pen as written in (1), the means which allows the ball valve to be spaced from a wall surface of the valve chamber and be held so as not to stop up the end hole of the tip is constructed such that:

the axis of the conduit is made coincident with the axis of the tip end hole;

a plurality of vertical ribs each having a different height are disposed in required positions on the peripheral wall of the valve chamber such that the axis of a cylindrical space defined by top surfaces of the ribs is made eccentric to the axis of the tip end hole and that channels defined by the ribs are adapted to flow ink when the pen is oriented downward; and

a valve which has a spherical shape at least on a surface that contacts with the conduit is put in the cylindrical space with play as the ball valve.

(4) In a ball-point pen as written in (1), the means which allows the ball valve to be spaced from a wall surface of the valve chamber and be held so as not to stop up the end hole of the tip is constructed such that the diameter of the valve chamber is greater than that of the ball valve while an annular edge portion defined by the tip rear hole is provided with a recess.

(5) In a ball-point pen as written in (1), the means which allows the ball valve to be spaced from a wall surface of the valve chamber and be held so as not to stop up the end hole of the tip is constructed such that the diameter of the valve chamber is greater than that of the ball valve while the tip rear end is cut obliquely with respect to the axial direction of the ball-point pen to form a slanted cut end.

(6) In a ball-point pen as written in any one of (1) through (5), the joint is composed of:

a squeezing pipe portion as the front part thereof having the tip fitting hole and the valve chamber in the axial central portion thereof;

an annular flange at the rear end of the squeezing pipe portion;

a fitting pipe portion disposed in the rear of the flange, for receiving at the rear end thereof an ink reservoir and a barrel; and

a plurality of vertical ribs, each having a linearly or curvingly slanting surface, disposed on the periphery of the squeezing pipe portion so as to form a tapered shape, the ribs being connected to the flange such that the rear ends of the ribs are in substantially level with the outer diameter of the flange, and

in this arrangement, a mouthpiece for covering tip is fixed abutting the barrel with a step portion inside the mouthpiece being in a good biting contact with the vertical ribs.

(7) In a ball-point pen as written in any one of (1) through (5), the ink reservoir is filled up with a so-called thixotropic ink (having shear viscosity decreasing property) which presents high viscosity at static state but lowers its viscosity due to the rolling of a ball at writing to provide easy ink flow while a follower which moves following to the consumption of ink and has a property preventing ink from vaporizing is provided at the rear end of the ink filled in the ink reservoir.

(8) In a ball-point pen as written in (7), the follower which moves following to the consumption of ink is greasy and a resin piece having a specific weight substantially equal to that of the follower is immersed in the follower.

(9) In a ball-point pen as written in (8), the follower which moves following to the consumption of ink is of a transparent or translucent greasy material filled in the rear end of ink reservoir and a colored resin piece having a specific weight substantially equal to that of the follower is immersed in the follower.

(10) In a ball-point pen as written in (6), a ventilating passage from a clearance at a front opening of the mouthpiece between the tip penetrated therethrough and the opening edge is communicated by way of channels defined between the ribs disposed on the peripheral surface of the squeezing pipe portion and the inner surface of the mouthpiece and by way of recesses formed at the front barrel end to an inner space inside the barrel; a cap which is fit in and fixed to the front barrel is formed integrally with an inner cap for hermetically covering the tip portion in a small room; a vent connecting from the inserting side to the rear end of the cap is formed between the cap and the inner cap; and the inner cap is further provided with a resilient, non-absorptive sealing piece made of a closed air-foam material for pressing the tip end.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a vertical cross-section showing a whole part of a ball-point pen of an embodiment of the present invention with a tip oriented upward;

Figs.2 to 6 are views showing an embodiment in association with a second feature (detailed in summary (2)) of the present invention in which the axis of a ball valve seat is disposed eccentrically to the axis of a tip end hole with a channel being provided on one side of a valve chamber hole; in particular,

Fig.2 is an enlarged vertical cross-section partially showing a ball-point pen of the embodiment with a tip oriented upward;

Fig.3 is a sectional view showing a joint used in the embodiment in association with summary (2) of the present invention;

Fig.4 is a cross-sectional view of the joint taken by a line A-A shown in Fig.3

Fig.5 is an enlarged cross-section showing a valve chamber portion of the embodiment in

association with summary (2) when the tip is oriented upward;

Fig.6 is an enlarged cross-section showing the valve chamber portion of the embodiment in association with summary (2) when the tip is oriented downward;

Fig.7 is an enlarged vertical cross-section partially showing a valve chamber portion of a ball-point pen of an embodiment in association with summary (4) with a tip oriented downward, where the axis of a ball valve seat is disposed in coincident with the axis of a tip end hole with a cut-in groove provided on an edge of the tip end hole;

Fig.8 is an enlarged vertical cross-section partially showing a valve chamber portion of a ball-point pen of an embodiment in association with summary (5) with a tip oriented downward, where the axis of a ball valve seat is disposed in coincidence with the axis of a tip end hole with the tip rear end being cut obliquely relative to the axial direction of the ball point pen;

Fig.9 is a vertical cross-section showing an entire part of a ball-point pen of an embodiment of the present invention with, in particular, a cap being fit in and a resin ring immersed in a follower;

Fig.10 is an enlarged vertical cross-section showing a front half of the embodiment shown in Fig.9;

Fig.11 is an enlarged vertical cross-section showing a rear half of the embodiment shown in Fig.9;

Fig.12 is a vertical cross-section partially showing a tip of a ball-point pen in association with summary (3) with the tip oriented upward;

Fig.13 is a vertical cross-section partially showing the tip of the ball-point pen in association with summary (3) with the tip oriented upward;

Fig.14 is an enlarged vertical cross-section showing a joint of the ball-point pen in association with summary (3); and

Fig.15 is a horizontal cross-section taken by a line A-A in Fig.12 of the ball-point pen in association with summary (3).

(Description of Reference numerals)

1	barrel
1a	inner space
2	mouthpiece
3	joint
4	ink reservoir
5	tip
5a	tip ball
6	barrel end
6a	recess
7	squeezing pipe portion
8	vertical rib
9	inner step portion
10	tip fitting hole
11	fitting pipe portion
11a	sealing projection
12	valve chamber
13	ball valve seat
14	ball valve
14a	hemispherical ball valve projection
15	channel
15a	vertical rib in valve chamber
16	flange
17	conduit
18	tip end portion
19	ink
20	follower
21	pipe piece
22	plug
23	cap
24	clip
25	inner cap
26	rib
27	small room
28	sealing piece
29	vent
30	cylindrical portion
31	engaging portion
32	engaging portion
33	a part of central axis line for tip fitting hole
34	central axis line of conduit
s	eccentricity

DETAILED DESCRIPTION OF THE INVENTION

A full explanation relating to a joint and tip end portion including means regulating a ball valve will be given in Fig. 2 - 8.

A ball-point pen of the present invention includes a joint which defines a ball valve seat 13 at an approximately central portion thereof in axial direction. The ball valve seat 13 constitutes one end of a conduit 17 which communicates with an ink reservoir. The joint also defines a valve chamber 12 in which a ball valve 14 is put with play and a tip fitting hole 10 in the front part of the valve chamber. In this structure, when the tip fitting hole 10 is positioned up, the ball valve 14 is fit on the ball valve seat 13 so as to stop up the conduit thereby preventing the ink from flowing back into the ink reservoir. In contrast, the joint further includes means regulating the ball valve 14 not to stop up the end hole of a tip 5 which is fit in the tip fitting hole 10 when the tip fitting hole 10 is positioned down.

One of such means can be constructed so that the conduit 17 of the ball valve seat 13 that communicates with the ink reservoir is disposed eccen-

trically in a proper manner relative to the end hole of the tip 5 but the valve chamber 12 is made to stay within a range of the inside circumference of the tip fitting hole 10. The eccentricity s is represented by an interval between a central axis line 33 of tip end portion and a central axis line 34 of conduit 17. In this case, as is apparent from Figs.2, 3, 4, 5 and 6, it is possible that the axis of the tip end hole is made coincident with that of the tip fitting hole while the axis of the conduit 17 communicating with the ink reservoir is made eccentric to the axis of the tip end hole. Alternatively, the axis of the conduit 17 may be made coincident with that of the ball-point pen while the tip end hole is disposed eccentrically relative to the tip fitting hole 10.

As another alternate means, it is possible to form a cutout or recess in a part of the edge of the tip end hole as shown in Fig.7 while the axes of the conduit and the tip end hole are coincident with each other.

As a further alternate means, it is possible to cut the edge of the tip end hole off obliquely with respect to the axial direction of the ball-point pen as shown in Fig.8 while the axes of the conduit and the tip end hole are coincident with each other.

The aforementioned means that does not stop up the end hole of the tip 5 includes all these configurations.

Still another alternate is shown in Figs.12 to 15. Here, the axis of the conduit is made coincident with that of the tip end hole while preferably a plurality of vertical ribs 15a each having a different height are disposed in required positions on the peripheral wall of the valve chamber. These ribs are provided in such a manner that a cylindrical space may be created by top surfaces of these ribs and the axis of the thus formed cylindrical space is made eccentric to the axis of the tip end hole. A valve which has a spherical shape at least on a surface that contacts with the conduit is put with play in the thus formed cylindrical space.

In this case, the axis of the ball valve placed on the communicating opening to the conduit is made eccentric to the axis of the conduit. The ball valve may be structured by a hemispheric form with a projection 14a on the plane side. Here, the projection 14a must be formed enough long to keep the hemispheric portion of the valve to orient toward the conduit and must be shaped so as not to be fit into the tip end hole. This hemispheric structure makes it possible to limit the length of the vertical ribs in the valve chamber to the vicinity of the ball valve seat.

Of these means, the embodiment shown in Figs.2, 3, 4, 5 and 6 will be hereinafter described in detail as a most preferred embodiment.

In this embodiment, the axis of the conduit 17 of the ball valve seat 13 that communicates with the ink reservoir is properly made eccentric to the axis of the tip fitting hole 10 while the valve chamber 12 is made to stay within a range of the inside circumference of the tip fitting hole. Accordingly, when the ball-point pen is oriented upward or with the ball valve being fit on ball valve seat 13, the center of the ball valve 14 is made eccentric in a little amount from the axis of the tip fitting hole 10 to form room on one side of the valve chamber.

A channel 15 is provided on the thus formed room on the side of the valve chamber. This structure allows the idly held ball 14 in the valve chamber 12 to abut the tip rear end 18 eccentrically in a writing position (with the tip downward) to create a ink flowing passage communicating from the ink reservoir through the conduit 17 and channel 15 to the ink tip. Thus, ink may be supplied into the tip.

The joint is mainly composed of a squeezing pipe portion 7, a flange 16 and a fitting pipe portion 11. A plurality of vertical ribs 8 of tapered form are extended along the length of the squeezing pipe portion 7 to the flange 16. These vertical ribs 8 press an inner step portion of a mouthpiece 2 (called as plastic mouthpiece if it is made of plastic) to contact with a good bite therewith when the mouthpiece 2 is screwed into the barrel so that the tip will not sway at writing.

Ink reservoir is filled with ink having thixotropic property, and a follower 20 that moves following the consumption of the ink is provided at the rear end of the ink so as to prevent the vaporization of the ink.

In this case, the follower composed of a transparent or translucent greasy material are filled over the ink with a colored resin piece immersed therein having a specific weight approximately equal to that of the follower, so that the remaining amount of ink can be clearly seen and that the tip ball can be prevented from slipping out by falling impacts. The aforementioned flange 16 is provided in an annular form at the rear end of the squeezing pipe portion 7 in the joint so that the front end of the barrel 1 is abutted against the rear side of the annular flange 16. The aforementioned ribs 8 are formed with linearly or curvingly slanting surfaces and provided at required positions on the outside surface of the squeezing pipe portion 7 while rear ends of the rib are connected with the flange 16 in level with the outside diameter surface of the flange. The aforementioned mouthpiece 2 is fixed to the barrel 1 with the inner step portion of the mouthpiece being contacted with a good bite to the peripheral portions of the ribs. Further, there is provided a ventilating passage communicating from the tip to an inner space 1a inside the barrel. More specifically, the ventilating passage from a clearance at the

front opening of the mouthpiece 2 between the tip 5 penetrated therethrough and the opening edge is communicated by way of channels defined between ribs 8 disposed on the peripheral surface of the squeezing pipe portion 7 and the inner surface of the mouthpiece and by way of recesses 6a formed at the front barrel end to the inner space 1a inside the barrel. On the other hand, a cap 23 which is fit in and fixed to the front barrel is formed integrally with an inner cap 25 for hermetically covering the tip portion in a small room. Formed across the cap 23 and the inner cap 25 is a vent which communicates from the inserting side to the rear end of the cap. The inner cap is further provided with a resilient, non-absorptive sealing piece 28 made of a closed air-foam material for pressing the tip end 5a.

EXAMPLES

The present invention will be hereinafter described more specifically with reference to embodiments, but the following examples is not intended to limit the present invention.

An embodiment of the present invention will be described with reference to Figs.1 to 6.

Fig.1 is a vertical cross-section showing a whole part of a ball-point pen with a tip oriented upward. Fig.2 is a vertical section showing a joint portion as a main part of Fig.1.

Referring to Fig.2, a joint 3 includes a squeezing pipe portion 7 disposed in the front half, a fitting pipe portion 16 in the rear half and a flange 16 between the former two.

The squeezing pipe portion 7 on the front side is provided on its outside surface with a plurality of tapered vertical ribs 8. The fitting pipe portion 11 is secured to an ink reservoir 4, which in turn is fit in with or covered by a barrel 1.

A tip 5 having a ball at the top thereof is press-fitted into, a tip fitting hole 10 disposed at the front end of the squeezing pipe portion 7.

The joint 3 is integrally molded of an elastically deformable synthetic resin and defines a valve chamber 12 behind the tip fitting hole 10 communicating therewith.

The principal surface of the valve chamber 12 is defined eccentrically to the axis of the tip fitting hole 10 with the valve chamber 12 being contained within a range of the inner periphery of the tip fitting hole 10. Further, the valve chamber 12 includes a ball valve seat 13 at the rear part thereof while the axis of the hole of the ball valve seat 13 is made eccentric with a proper eccentricity (eccentricity S) relative to the axis of the tip fitting hole 10. Moreover, a channel 15 is provided on one side of the valve chamber space.

A ball valve 14 is put with play inside the valve chamber 12. Formed in the center portion of the ball valve seat 13 is a conduit 17 which communicates with the ink reservoir disposed therebehind.

The flange 16 is provided at the rear end of the squeezing pipe portion 7 and the fitting pipe portion 11 is extended backward from the rear side of the flange 16.

The cylindrical ink reservoir 4 is pressingly secured to the outside periphery of the fitting pipe portion 11 in such a manner that the front end of the reservoir 4 abuts the rear side of the flange 16 while the inner portion of the ink reservoir 4 communicates with the conduit 17 of the joint 3. Filled inside the ink reservoir 4 is thixotropic ink 19 (having shear viscosity decreasing property) which presents high viscosity at static state but lowers its viscosity to provide easy flow of ink due to the rolling of a ball at writing (Fig.1). Filled at the rear of the ink 19 is a greasy follower 20 which is in contact with the ink surface for preventing the ink from vaporizing and moves as the ink decreases. It should be also noted that the ink reservoir 4 is formed of a transparent polypropylene resin molding and the like which inhibits vaporization of ink.

The joint 3 securely joins the tip 5 with the ink reservoir 4 full of ink to form a writing portion. The thus formed writing portion is inserted into the barrel 1 from the front end thereof until the rear side of the flange 16 of the joint 3 abuts the front side of the barrel end 6. Then the mouthpiece 2 is screwed into the barrel end 6 of the barrel 1 with vertical ribs 8 of the squeezing pipe portion 7 being in a biting contact with the inner step portion 9 of the mouthpiece 2. Further, a vent or some vents for communicating with the inner space of the barrel are provided in appropriate positions on the barrel 1. Alternatively, a vent (not shown) in communication with the barrel inside is provided in a plug 22 squeezed at the rear end of the barrel 1.

Fig.6 shows a writing state where the tip is oriented downward. In this state, the ball 14 abuts the tip end 18 with offset to one side. Accordingly, a channel which allows the ink to flow into the tip 5, e.g. an ink flowing passage 19a is formed on the other side. Ink is supplied from the ink reservoir 4 through the conduit 17 to the valve chamber 12. The ink in the valve chamber 12 further passes through the channel 15 and the ink flowing passage 19a and is lead to the front end of the tip 5. The ink presents a high viscosity at static state, but the viscosity of the ink is lowered by the rolling of the ball at the end of the tip 5 so as to flow out a large quantity of ink. Accordingly, it is possible to perform writing in high density free from blotting. Figs.2 and 5 show a state in which the tip 5 is oriented upward. In this state, the ball 14 is placed on the ball valve seat 13 of the valve chamber 12

to stop up the conduit 17. Accordingly, even when the ink immediately under the ball of the tip is exhausted by writing in the downside-up position, no head is acted on the ink and therefore no back leaking occurs. In addition, in the present invention, since the tip 5 is squeezed into the tip fitting hole 10 of the squeezing pipe portion 7 in the joint 3 while the inner step portion 9 of the mouthpiece 2 abuts or is brought in a biting contact with vertical ribs 8, the tip 5 is prevented from moving or swaying relative to the mouthpiece 2.

Next, an embodiment shown in Figs.9, 10 and 11 will be described. As shown in Fig.10, a front half part of a joint 3 is composed of a squeezing pipe portion 7 which is provided in required positions with linear or curved ribs 8. There is formed an annular flange 16 at the rear side of ribs 8 in such a manner that the rear ends of ribs 8 are substantially leveled with the outside surface diameter side face of the flange 16. The joint 3 includes a fitting pipe portion 7 as a rear half part thereof and an ink reservoir is secured to the fitting pipe portion 11. Squeezed into a tip fitting hole 10 disposed at the front end of the squeezing pipe portion 7 is a rear end of a tip 5 that holds a tip ball 5a.

The joint 3 is integrally molded of an elastically deformable synthetic resin and defines a valve chamber 12 behind the tip fitting hole 10 communicating thereto. Provided in the rear part of the valve chamber 12 is a frustum-shaped ball-valve seat 13. The principal surface of the valve chamber 12 is defined eccentrically to the axis of the tip fitting hole 10 with the valve chamber 12 being contained within a range of the inner periphery of the tip fitting hole 10. Further, the axis of a hole in the valve chamber 12 is made eccentric properly relative to the axis of the tip fitting hole 10. A channel 15 is provided on one side of the valve chamber space. A ball valve 14 is put with play inside the valve chamber 12. Formed in the rear part of the valve chamber 12 is a conduit 17 which communicates with the ball valve seat 13. Meanwhile, if the rear end hole of the tip is disposed eccentrically relative to the tip fitting hole 10, the valve chamber 12 is not necessarily made eccentric.

The flange 16 is provided on the rear side of the squeezing pipe portion 7 and the fitting pipe portion 11 is extended backward from the rear side of the flange 16.

The cylindrical ink reservoir 4 is pressingly secured to the outside periphery of the fitting pipe portion 11 in such a manner that the front end of the reservoir 4 abuts the rear side of the flange 16 while the inner portion of the ink reservoir 4 communicates with the conduit 17 of the joint 3. Filled inside the ink reservoir 4 is thixotropic ink 19 (having shear viscosity decreasing property) which presents high viscosity at static state but lowers its viscosity to provide easy flow of ink due to the rolling of the tip ball at writing. Moreover, filled at the rear of the ink 19 is a transparent or translucent greasy follower 20 which is in contact with the ink surface for preventing the ink from vaporizing and moves as the ink decreases. A colored resin piece having a specific weight approximately equal to that of the follower is immersed in the follower 20. In this embodiment, the colored resin piece is of a pipe piece 21 composed of PP resin or the like, and is immersed in the follower 20 with the inside and outside of the piece 21 filled with the follower 20. Alternatively, the pipe piece 21 is positioned such that a rear part of the pipe piece 21 projects over the rear end of the follower 20. Here, the colored resin piece is not limited to the pipe piece but may be replaced with a rod piece or ball which has an outside diameter properly smaller than the inner diameter of the ink reservoir 4 and is immersed in the follower. Here, it is should be noted that the ink reservoir 4 is formed of a transparent PP resin molding and the like which inhibits vaporization of ink. The thus composed arrangement of the tip 5, joint 3 and ink reservoir 4 forms a refill of the ball-point pen. The rear end of the barrel 1 is attached with a plug 22.

The thus formed refill of the tip 5 and the ink reservoir 4 secured together by the joint 3 with the reservoir 4 filled with ink is inserted into the barrel 1 from the front end thereof until the rear side of the flange 16 of the joint 3 abuts the front side of the barrel end 6. Then the mouthpiece 2 is screwed into the barrel end 6 of the barrel 1 in a state where linear or curved ribs 8 disposed in required positions on the squeezing pipe portion 7 are in a biting contact with the inner step portion 9 of the mouthpiece 2. Here, the front side of the barrel end 6 is provided at required positions with recesses 6a and is abutted by the rear end of the flange 16 of the joint 3. The barrel 1 is formed of a transparent resin molding so that the consumption of ink can be seen. In this arrangement, a ventilating passage from the clearance at the front opening of the mouthpiece between the tip 5 penetrated therethrough and the opening edge is formed so as to be introduced through channels between ribs 8 disposed on the squeezing pipe portion 7 and the inner surface of the mouthpiece 2 and recesses 6a formed at the front side of the barrel end 6 to the inner space 1a inside the barrel 1. Further, a vent or some vents are provided, as required, on a side surface of the barrel 1, or on the plug 22 or between the plug and the barrel, in order to communicate between the inner space 1a and the outside atmosphere.

Meanwhile, a cap 23 that covers the front barrel includes a clip 24 on the outer peripheral side thereof. This clip 24 is fixed to the cap 23 by press-fitting the cylindrical portion 30 disposed at the rear of the clip into a rear end hole of the cap 23. A vent 29 penetrates through the rear end of the cylindrical portion 30. In a deeper part of the inner hollow of the cap 23 there is provided a cylindrical inner cap 25 defining a small room 27. This inner cap 25 is integrally formed with the cap 23 using a required number of ribs 26 held by the inner surface of the cap 23. By the arrangement, a ventilating passage can be formed through the channels between the ribs from the cap inserting opening to the vent 29. It should be noted that formation of ventilation can be carried out in various methods and is not limited to the above particular structure. An engaging portion 32 is disposed around the inserting opening of the cap 23 and is detachably engaged with another engaging portion 31 disposed on the barrel 1. Here, this engagement is constructed by a familiar way such as an snap-fitting engagement between projection and recess. At the front end of the small room 27 of the inner cap 25 there is fixed a resilient, non-absorptive sealing piece 28 made of a closed air-foam material, so that the tip ball 5a is properly pressed by the sealing piece 28 while the tip 5 and the mouthpiece 2 is hermetically confined in the small room 27.

In the embodiment, since the ball valve 14 comes in annular contact with the ball valve seat 13 in the valve chamber 12 to seal the conduit 17 as shown in Fig.10 when the tip 5 is oriented upward, it is possible to prevent the ink from flowing backward in the state of downside-up writing. Since, as shown in Fig.10 where the front barrel is capped by the cap 23, the front end of the tip 5 abuts the sealing piece 28, no trouble of the tip ball 5a slipping out due to falling impacts can occur. Additionally, since the ball valve 14 is put with play in the valve chamber 12 in such a manner as to be made eccentric properly to the tip end hole 18, no trouble occurs of the ball valve biting into the tip end hole when the refill with ink filled up is subjected to the centrifugal separation upon the manufacture. From the same reason, if the ball valve 14 abuts the tip end portion 18, the ball valve is set off the center so that the ink flowing channel into the tip 5 can be surely established. Further, since the colored resin piece is immersed in the follower 20, not only can the exhaustion of ink be clearly seen, but also the total inner friction is increased even if the flow resistance of the follower lowers as compared to the system with no resin piece. Accordingly, more reliable safety against back leaking can be assured and impactive pressurization on the tip ball 5a caused by shocks can be relaxed so that it is possible to prevent the tip ball 5a from slipping out even when the cap 23 is not placed. Since the tip ball 5a is hermetically confined by the inner cap 25, it is possible to prevent the tip ball 5a from drying as well as to prevent the ink from vaporizing. On the other hand, since the air passage is established from the tip opening of the mouthpiece 2 to the inner space 1a inside the barrel 1, the augment and reduction of pressure inside the barrel due to attachment or removal of the cap can be relieved so that it is possible to prevent the problem of air bubbles flowing into the ink. Moreover, in case an infant accidentally swallowed the cap, the vent 29 would allow the infant to breathe. Since the outside surface of ribs 8 formed on the squeezing pipe portion 7 in the joint 3 are brought in biting contact with the inner step portion 9 of the mouthpiece 2, movement or swaying of the tip 5 relative to the mouthpiece 2 can be prevented.

Configurations and operations of the ball-point pen according to the present invention have been described heretofore. In the present invention, since, by providing a valve chamber for an intermediate portion communicating between a tip and an ink reservoir, the ink reservoir is adapted to be separated from the valve chamber by a ball put with play inside the valve chamber when the tip of the ball-point pen is oriented upward at writing, ink can be prevented from leaking backward so that it is possible to avoid accidents such as of polluting the barrel inside, hands, clothes and the like. In addition, since no undercut projection for preventing the ball from slipping out is formed in the valve chamber as formed in the conventional example, neither the problem as to dimensional accuracy nor the trouble at inserting the ball can occur. It is also possible to solve the problems of the ball biting into the rear end of the tip when the tip is subjected to the centrifugal operation for removing bubbles in the ink upon loading of ink. Since the ribs formed on the squeezing pipe portion in the joint are brought in biting contact with the inner step portion of the mouthpiece, movement of the tip 5 relative to the mouthpiece 2 may be prevented. Accordingly, sway of the tip can be inhibited presenting a good feeling with writing. Since the augment and reduction of pressure inside the barrel due to attachment or removal of the cap can be inhibited so that air bubbles are prevented from flowing into the ink. This may provide smooth writing performance. Moreover, it is possible by providing a simple means to prevent the tip ball from drying as well as to prevent the ink from vaporizing.

As to the centrifugal operation, tips of refills must be abutted against a certain surface in a container of a centrifugal separator; otherwise ink would spout out from the tip end to pollute the

container. Conventional refills would be entangled with one another when bundled for loading the refills in the container of the centrifugal separator. This would keep some refills at their tips spaced from the abutted surface to thereby pollute the container. In the present invention, since the ribs having linearly or curvingly slanting top surfaces are provided on the joint in such a manner that the ribs are in level with the flange outside diameter surface at their adjoining points, no refills are entangled with each other at the joint portions when refills are bundled for the centrifugal operation in the container of the centrifugal separator. Therefore, tips of the refills can be properly abutted in place so that it is possible to prevent ink from spouting out from those tip and therefore it is possible to avoid the pollution of the container.

In addition, since the ball valve is put with play in the valve chamber in such a manner that the ball is made eccentric properly to the tip fitting hole, no trouble occurs of the ball valve biting into the tip end hole at the centrifugal separation. It is also possible to prevent ink from flowing backward at writing with the tip oriented upward. Further, since the colored resin piece is immersed in the follower, not only can the exhaustion of ink be clearly seen, but it is also possible, regardless of whether the cap is attached or not, to prevent the back leaking of ink and the slipping out of the tip ball, both caused by falling impact. Moreover, in case an infant accidentally swallowed the cap and the cap stuck in its throat, it is possible to avoid a hazard of choking. Besides, no gap between the tip and the mouthpiece provides a good feeling with writing.

Claims

1. A ball-point pen equipped with a back leaking preventing mechanism comprising:

a joint comprising:

a valve chamber disposed in an approximately middle portion of said joint with respect to the axial direction thereof for holding a ball valve therein with play, said valve chamber further having a ball valve seat in the rear part thereof;

a tip fitting hole disposed in front of said valve chamber; and

a conduit disposed in the rear of said valve chamber and communicating therewith via said ball valve seat,

said joint holding a tip by said tip fitting hole and holding an ink reservoir communicating with said conduit; and

means which allows said ball valve to fit on said ball valve seat so as to stop up said conduit when said tip fitting hole is oriented upward and which allows said ball valve to be spaced from a wall surface of said valve chamber and be held so as not to stop up the end hole of said tip fit into said tip fitting hole when said tip fitting hole is oriented downward.

2. A ball-point pen according to claim 1, wherein said means which allows said ball valve to be spaced from a wall surface of said valve chamber and be held so as not to stop up the end hole of said tip is constructed such that the axis of said ball valve seat is made eccentric relative to the axis of said tip end hole and that a channel is provided on one side of said valve chamber space.

3. A ball-point pen according to claim 1, wherein said means which allows said ball valve to be spaced from a wall surface of said valve chamber and be held so as not to stop up the end hole of said tip is constructed such that:

the axis of said conduit is made coincident with the axis of said tip end hole;

a plurality of vertical ribs each having a different height are disposed in required positions on the peripheral wall of said valve chamber such that the axis of a cylindrical space defined by top surfaces of said ribs is made eccentric to the axis of the tip end hole and that channels defined by said ribs are adapted to flow ink when the pen is oriented downward; and

a valve which has a spherical shape at least on a surface that contacts with the conduit is put in said cylindrical space with play as said ball valve.

4. A ball-point pen according to claim 1, wherein said means which-allows said ball valve to be spaced from a wall surface of said valve chamber and be held so as not to stop up the end hole of said tip is constructed such that the diameter of said valve chamber is greater than that of said ball valve while an annular edge portion defined by said tip rear hole is provided with a recess.

5. A ball-point pen according to claim 1, wherein said means which allows said ball valve to be spaced from a wall surface of said valve chamber and be held so as not to stop up the end hole of said tip is constructed such that the diameter of said valve chamber is greater than that of said ball valve while said tip rear end is cut obliquely with respect to the axial direction of the ball-point pen to form a slanted cut end.

6. A ball-point pen according to any one of claims 1 through 5, wherein said joint is com-

posed of:

a squeezing pipe portion as the front part thereof having said tip fitting hole and said valve chamber in the axial central portion thereof;

an annular flange at the rear end of said squeezing pipe portion;

a fitting pipe portion disposed in the rear of said flange, for receiving at the rear end thereof an ink reservoir and a barrel; and

a plurality of vertical ribs, each having a linearly or curvingly slanting surface, disposed on the periphery of said squeezing pipe portion so as to form a tapered shape, said ribs being connected to said flange such that the rear ends of said ribs are in substantially level with the outer diameter of said flange, and

in this arrangement, a mouthpiece for covering tip is fixed abutting said barrel with a step portion inside the mouthpiece being in a good biting contact with said vertical ribs.

7. A ball-point pen according to any one of claims 1 through 5, wherein said ink reservoir is filled up with a so-called thixotropic ink (having shear viscosity decreasing property) which presents high viscosity at static state but lowers its viscosity due to the rolling of a ball at writing to provide easy ink flow while a follower which moves following to the consumption of ink and has a property preventing ink from vaporizing is provided at the rear end of the ink filled in said ink reservoir.

8. A ball-point pen according to claim 7 wherein said follower which moves following to the consumption of ink is greasy and a resin piece having a specific weight substantially equal to that of said follower is immersed in said follower.

9. A ball-point pen according to claim 8 wherein said follower which moves following to the consumption of ink is of a transparent or translucent greasy material filled in the rear end of ink reservoir and a colored resin piece having a specific weight substantially equal to that of said follower is immersed in said follower.

10. A ball-point pen according to claim 6 wherein a ventilating passage from a clearance at a front opening of said mouthpiece between said tip penetrated therethrough and the opening edge is communicated by way of channels defined between said ribs disposed on the peripheral surface of said squeezing pipe portion and the inner surface of said mouthpiece and by way of recesses formed at the front barrel end to an inner space inside said barrel; a cap which is fit in and fixed to the front barrel is formed integrally with an inner cap for hermetically covering said tip portion in a small room; a vent connecting from the inserting side to the rear end of the cap is formed between said cap and said inner cap; and said inner cap is further provided with a resilient, non-absorptive sealing piece made of a closed air-foam material for pressing the tip end.

11. A ball-point pen according to any of claims 1 to 10 wherein said conduit disposed in the rear of said valve chamber communicates with said chamber in the radially central portion of said ball valve seat.

12. The ball-point pen of any of claims 1 to 10 wherein said conduit disposed in the rear of said valve chamber communicates with said valve chamber in a portion offset from the radial center of said ball valve seat.

FIG.1

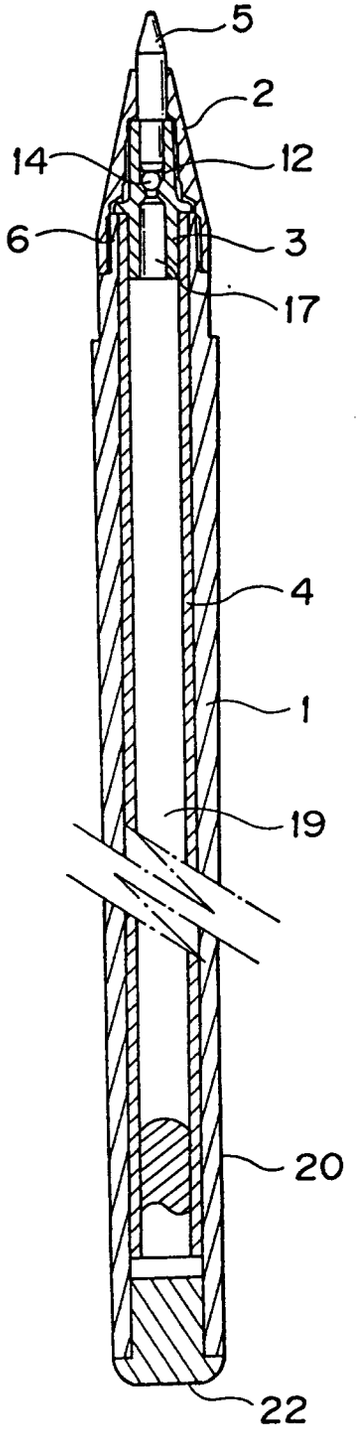


FIG.2

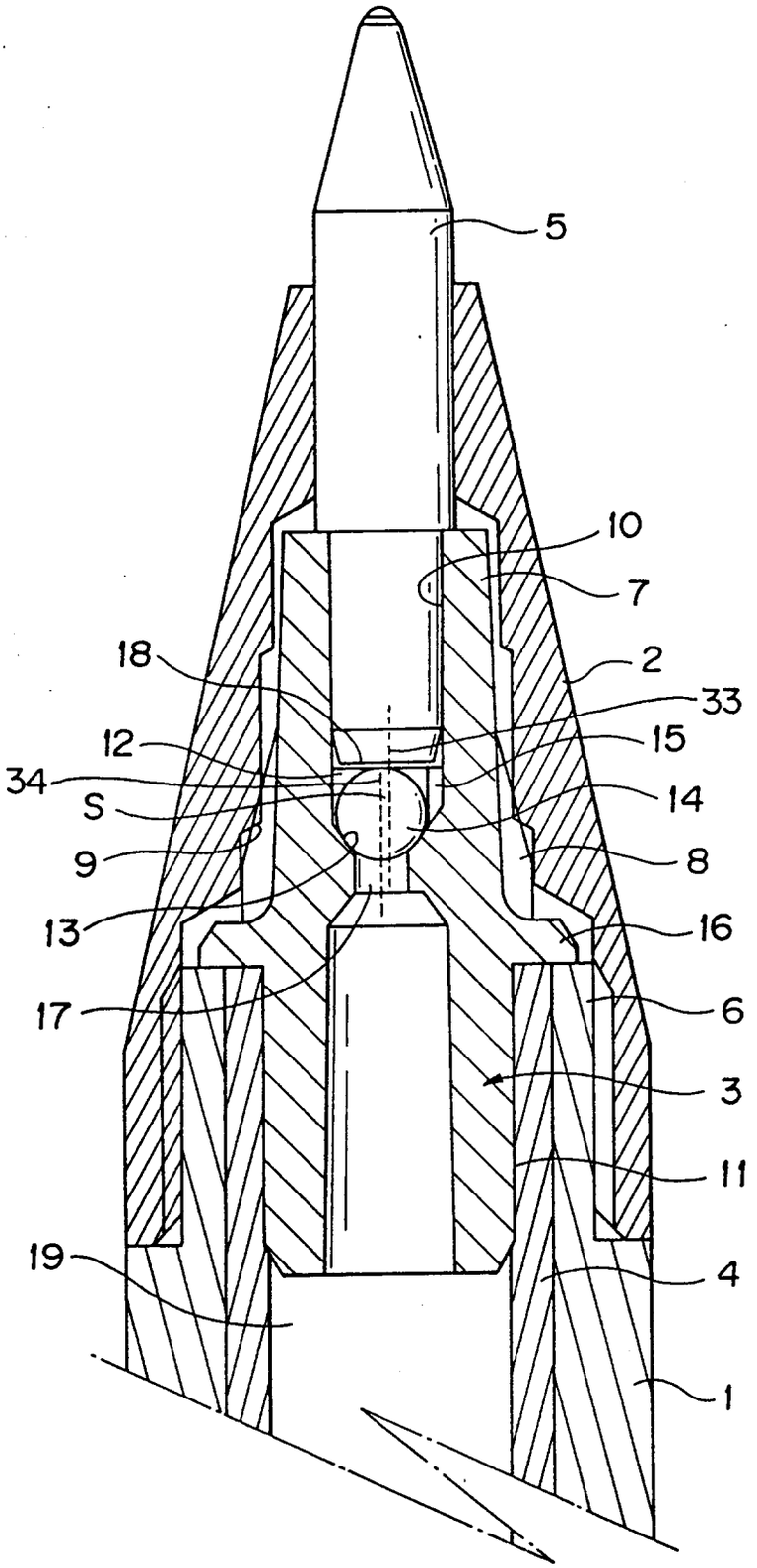


FIG. 3

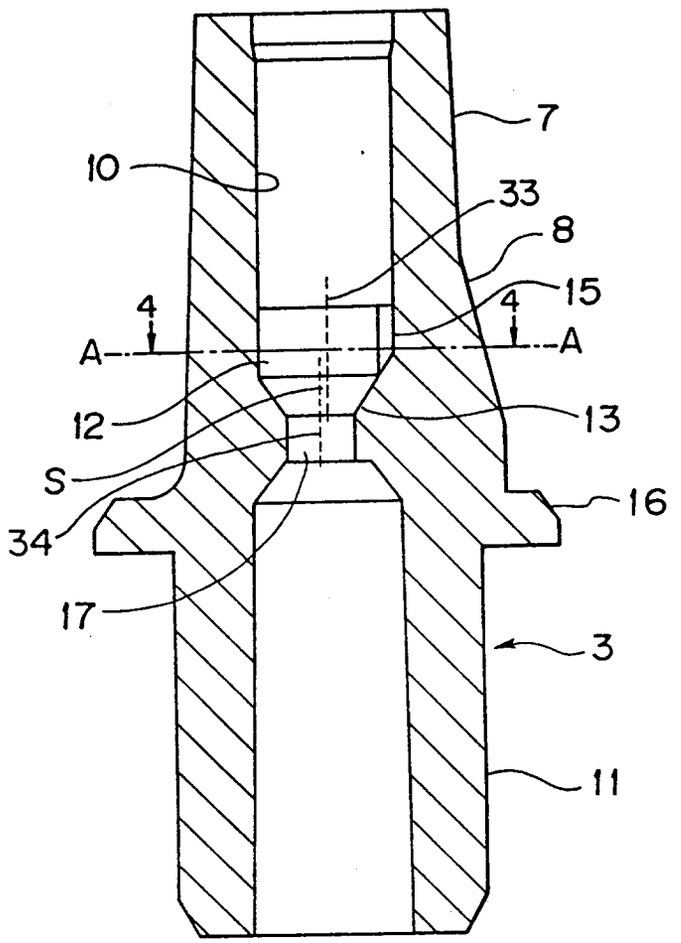


FIG. 4

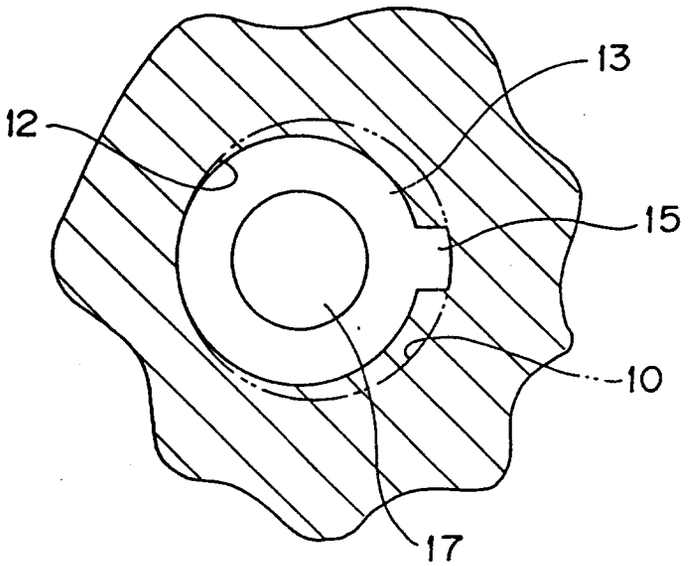


FIG. 5

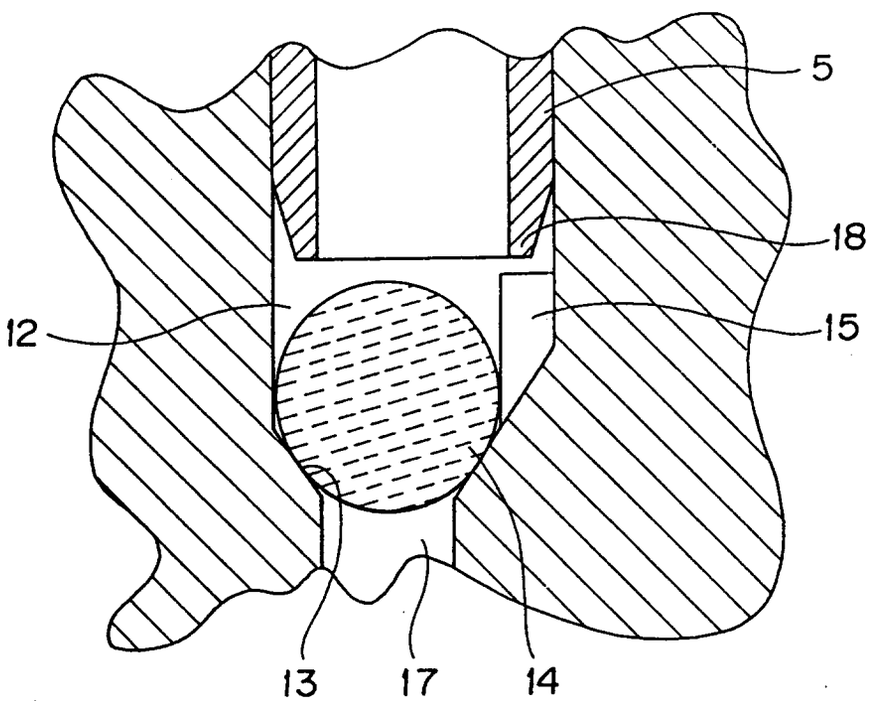


FIG. 6

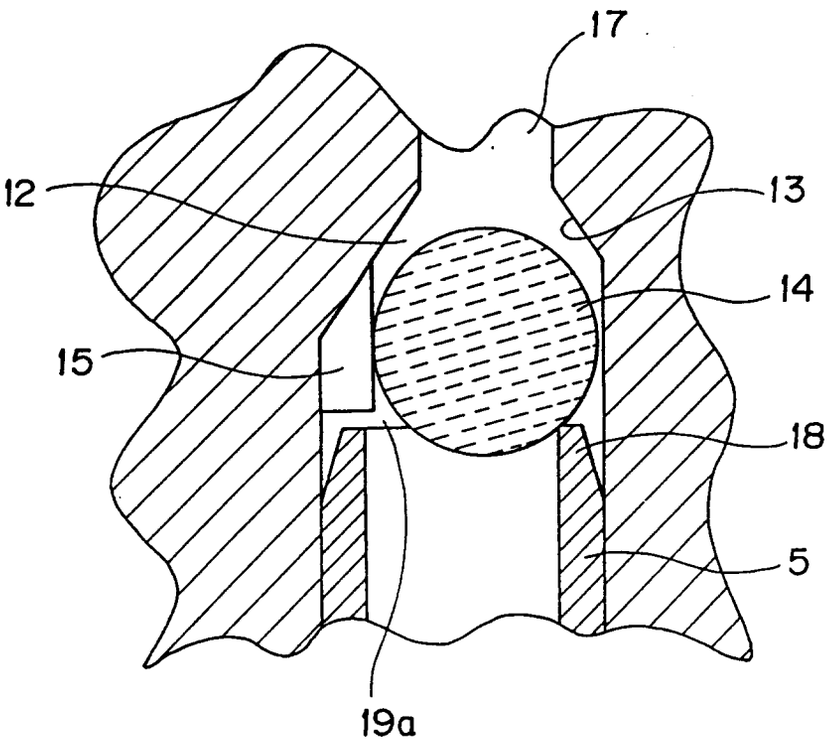


FIG. 7

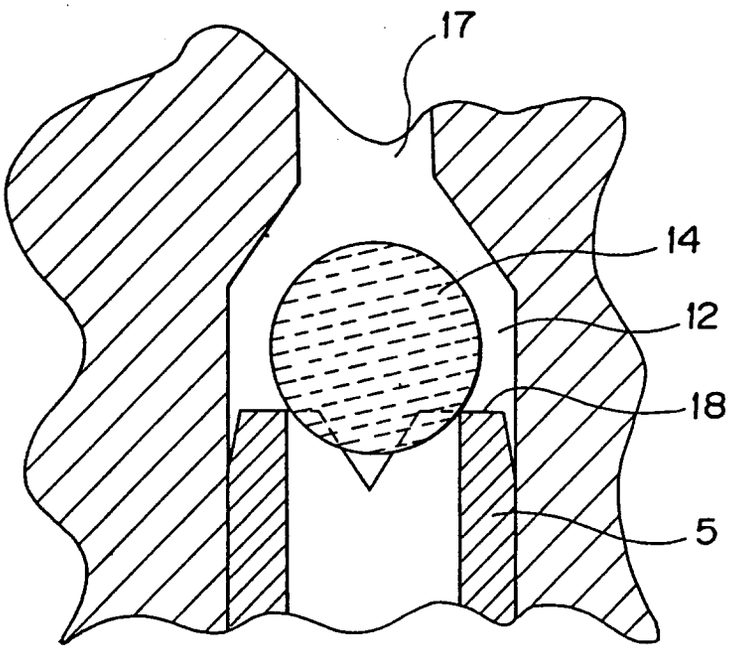


FIG. 8

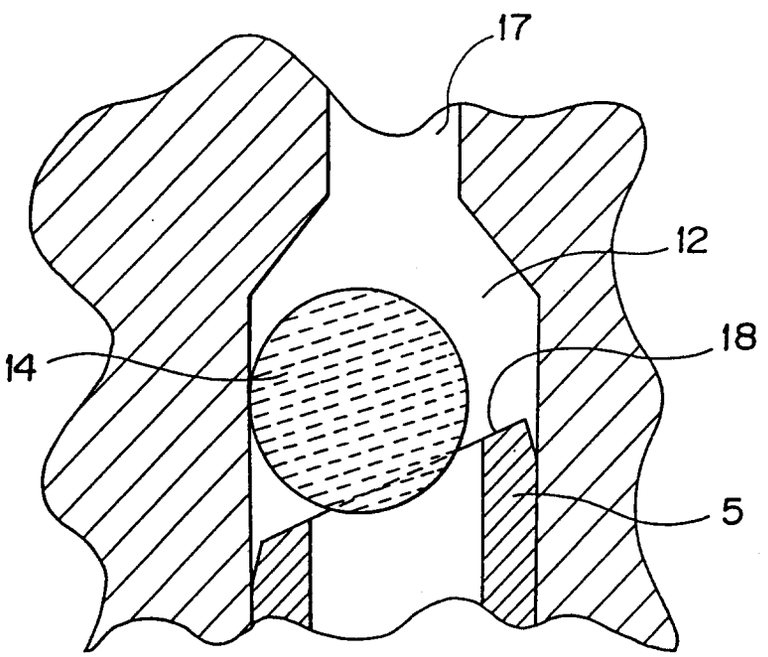


FIG. 9

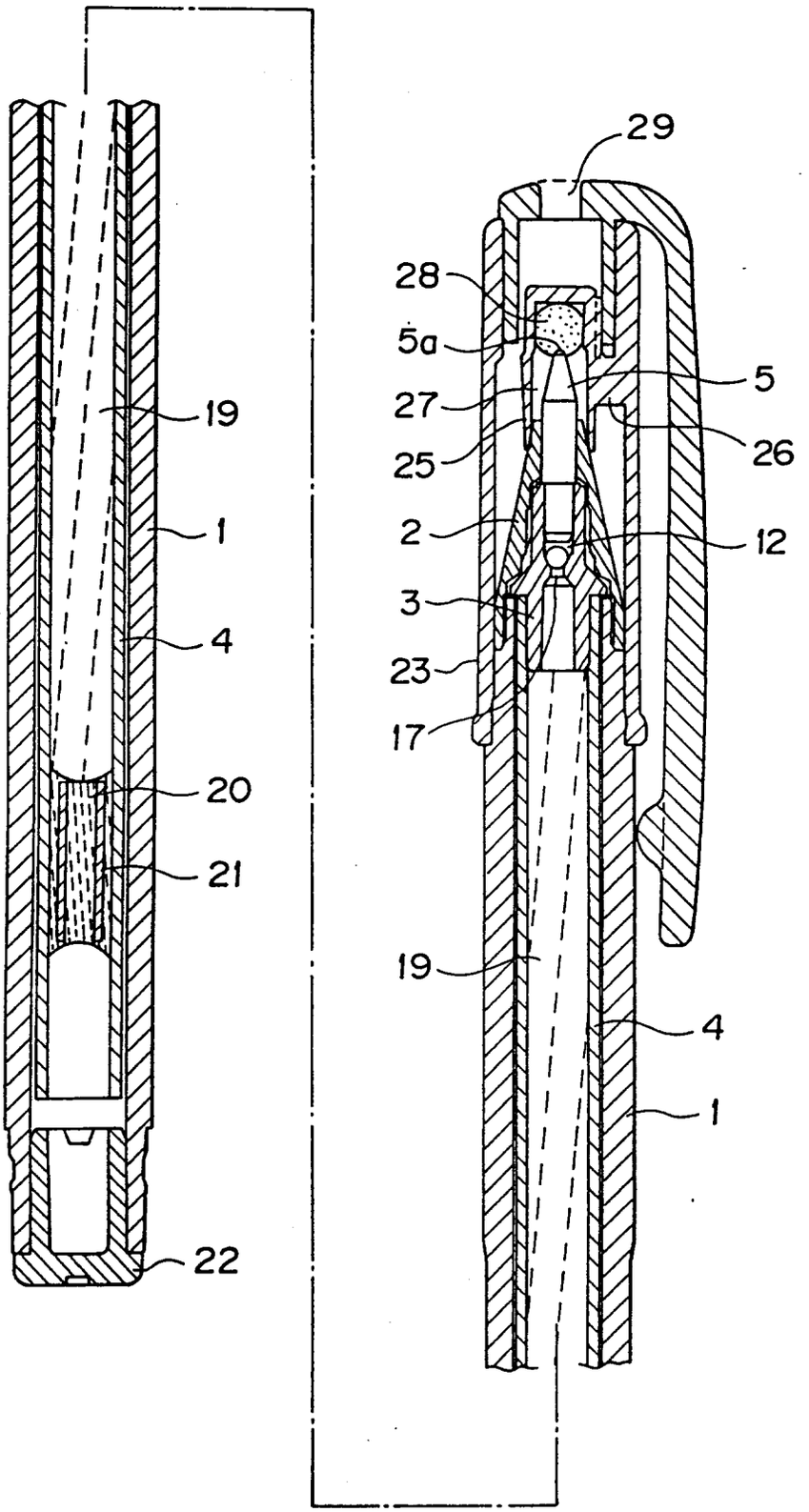


FIG. 10

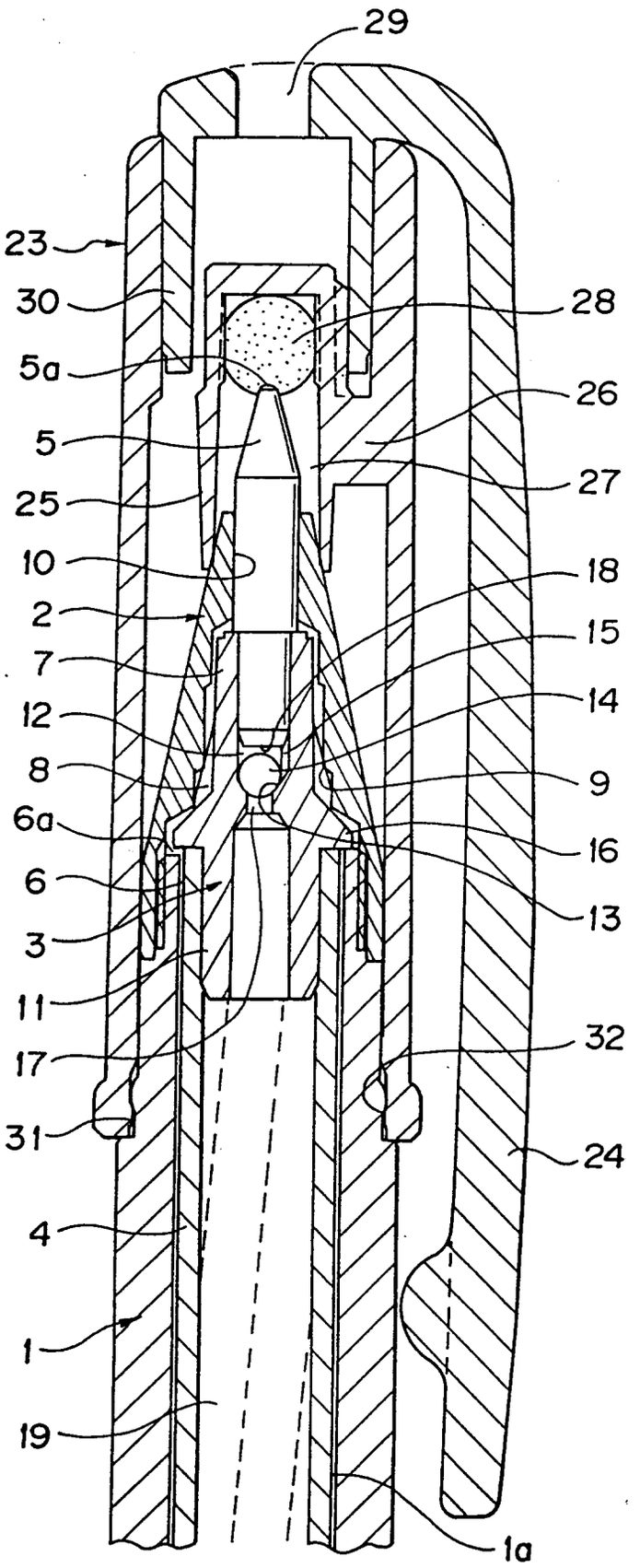

29
23
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28
5a
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14
12
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6a
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19
1a

FIG. 11

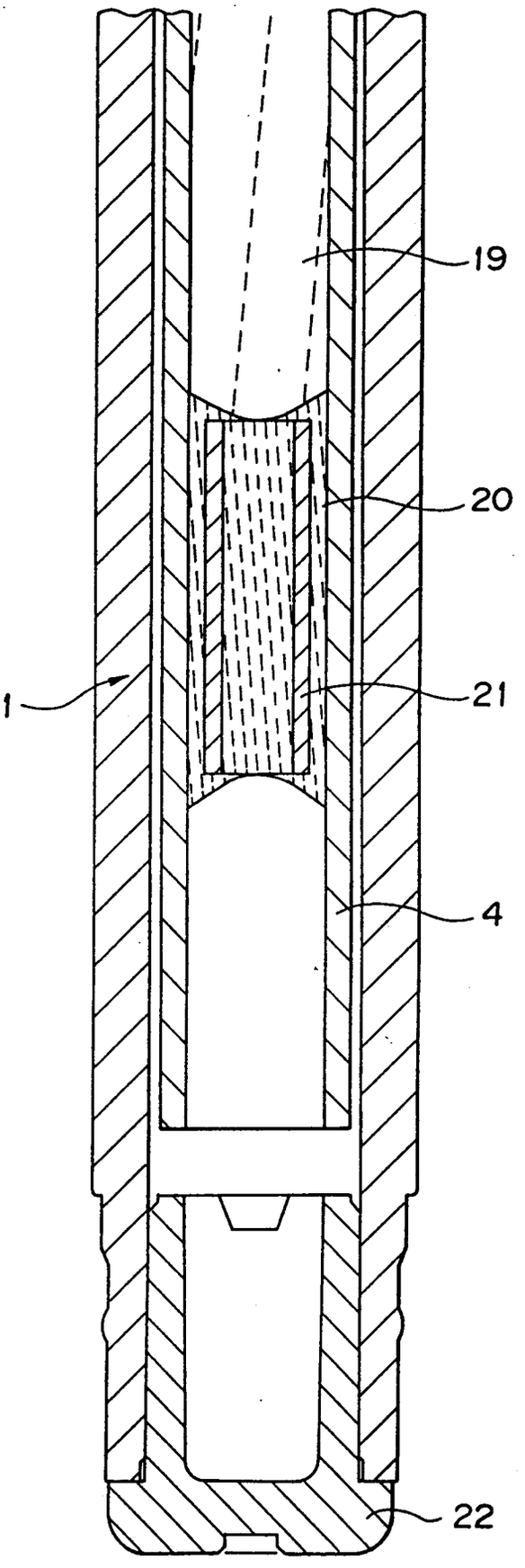


FIG. 12

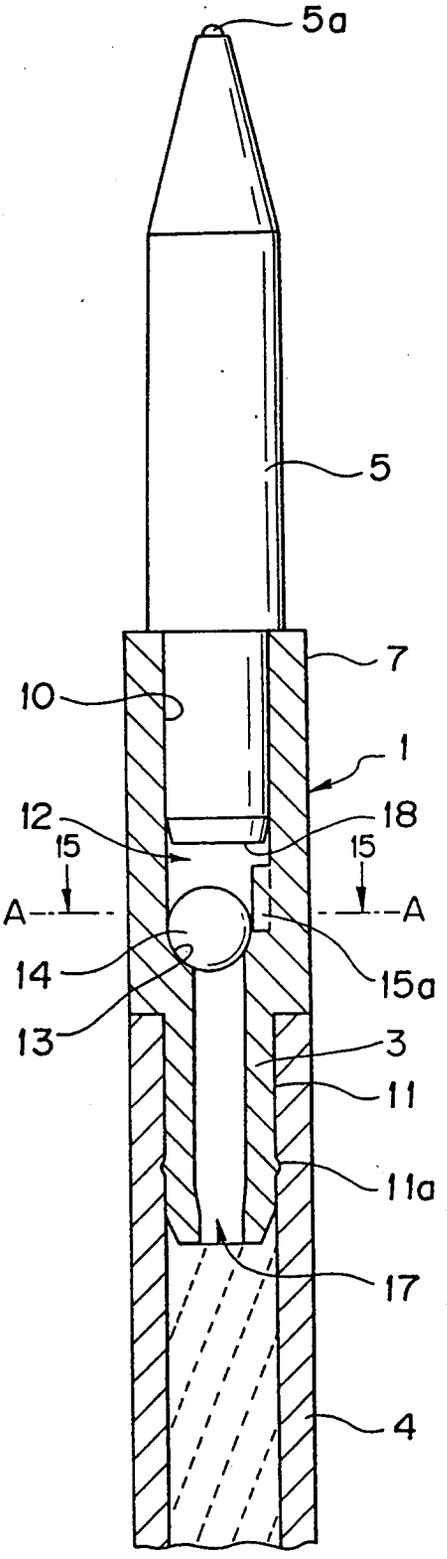


FIG. 13

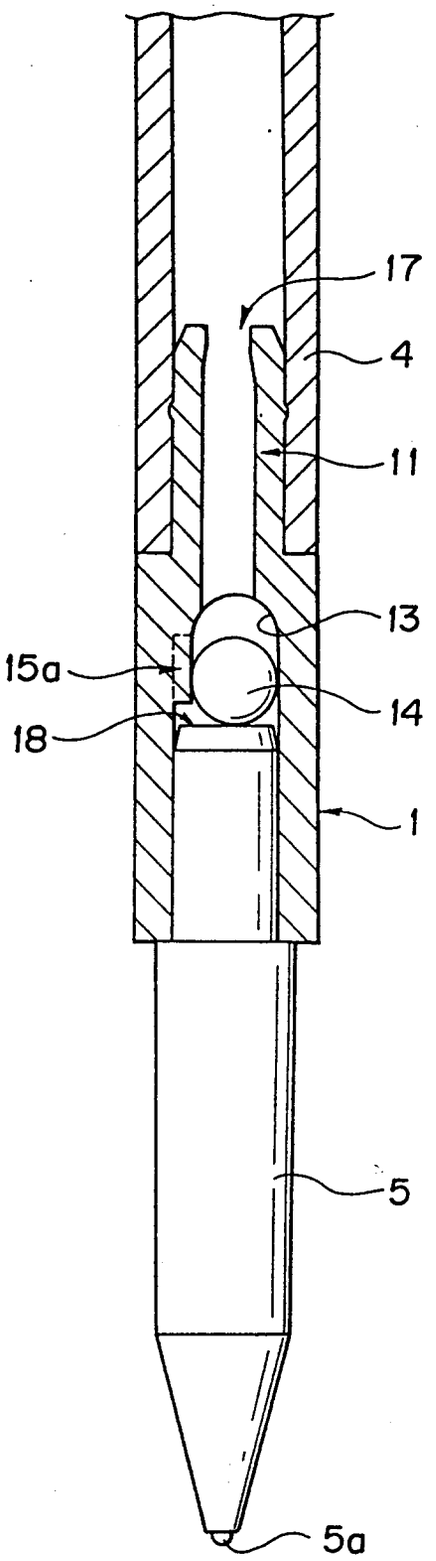


FIG. 14

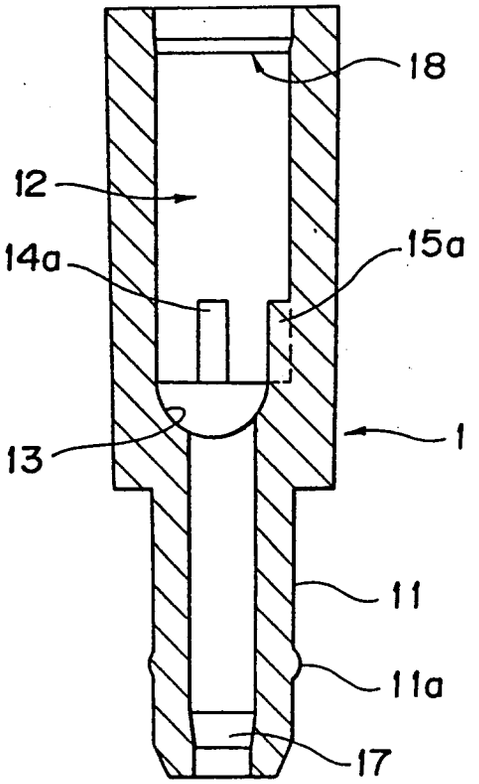
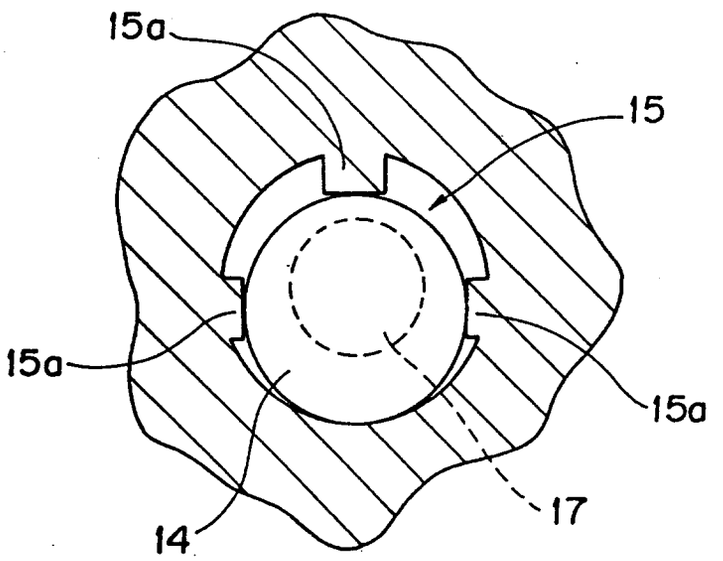


FIG. 15



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 10 4220

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
D,X	JP-Y-452 067 (...) * figures 1-3 *	1,11	B43K7/08 B43K7/00
Y		7	B43K23/00
Y	WO-A-86 04345 (THE GILETTE COMPANY) * page 2, line 26 - page 3, line 17 *	7	
X	GB-A-2 078 175 (ZEBRA CO.) * abstract; figures 2A,2B,3 *	1,11	
Y		7	
Y	ENGINEERING, vol.209, no.5428, 15 May 1970 page 507 WOODYARD D. 'ink fit for spacemen' * the whole document *	7	
A	FR-A-971 021 (BIRO PATENTE) * page 2, left column, paragraph 2; figure 3 * * page 4, right column, last paragraph - page 5, left column, paragraph 4 *	1	
A	FR-A-1 056 717 (AVERMATE) * page 1, right column, last paragraph; figures *	1	
A	FR-A-1 497 176 (PAPER MATE) * page 3, right column, paragraph 4; figure 2 *	8,9	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
B43K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 October 1994	Perney, Y

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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