

BALLPOINT PENS

The present invention relates to improvements made to ballpoint pens using replacement refills in the form of ink cartridges as the ink supply. It relates in particular to pressurization of such refills.

5 It is known that, in refills of this type, it is necessary for the gas-filled space between the end of the refill opposite to the writing tip and the ink to be kept at a pressure close to ambient pressure to prevent a pressure drop during writing which would oppose proper flow of the ink, or to prevent an overpressure likely to overfeed the ink.

10 With this goal, it has been proposed that the gas filled ends of such refills be provided with an orifice designed to ensure communication between the end of the refill and the atmosphere. Although such an arrangement is particularly satisfactory when the ink contained in the refill has low volatility, this is not so when the ink has high volatility as evaporation of the ink causes loss of ink and speedy exhaustion of the refill.

15 To overcome this disadvantage, it has been proposed that the orifice or orifices be disposed in the part of the refill adjacent the writing tip thereof and that they be made to communicate with the gas filled space end of the refill by a duct provided inside the ink reservoir. However, such an arrangement only prevents overconsumption of ink if the user has taken care to cover the pen writing tip with its cap when the pen is not in use.

20 There is thus a need for satisfactory pressurization of ballpoint pen refills ensuring limitation of ink consumption when the user fails to re-cover the pen writing tip with the cap when the pen is not in use, and even for a pen which does not require the presence of such a cap.

25 According to the present invention there is provided a ball-point pen of the type comprising an ink refill slidably mountable in the interior of a body of the pen for movement between two endmost positions, namely a rest position in which a writing tip is retracted into the body of the pen and a writing position in which said tip projects outside the body of the pen, which
30 refill is of the type comprising in the vicinity of the writing tip at least one orifice adapted to supply the refill with air, wherein the pen has a chamber, provided between a casing integral with the body of the pen and a refill when present therein, sealed against the ambient atmosphere both in the rest position and in the writing position, the refill orifice opens into the

chamber when the refill is present in the pen and means are provided for placing this chamber in communication with the ambient atmosphere every time that the refill passes from the rest position to the writing position, there being ducts provided for connecting the refill orifice in the vicinity of the writing tip with a gas filled space in the refill between the ink and the end of the refill remote from the writing tip, and the pen body interior is in communication with the external ambient atmosphere.

In an embodiment of the invention, over the entire length of the refill, the space between the casing thereof and the body of the pen is used to constitute said chamber. It has in fact been found that it is sometimes useful to have a chamber with a relatively large volume, in particular to damp certain pressure variations likely to occur during use.

In another embodiment of the invention, the seal between the refill and the pen body is provided by a bellows. This arrangement provides a practically frictionless airtight connection between the two parts.

This arrangement also enables a permanent equilibrium to be provided between the chamber pressure and atmospheric pressure in both the rest and writing positions.

It is useful in the writing position, since (particularly in the case of pens whose bodies are made of conductive materials) it prevents pressure increases of the air contained in the chamber due to heating caused, for example, by contact with the user's hand, from leading to overabundant ink flow.

It is also useful in the rest position, since it enables this same type of incident to be prevented when, due to changes in altitude (particularly in the case of an airplane trip, etc.) the pressure of the chamber is higher than atmospheric pressure.

Since these pressure adjustments are not affected by the volume of the chamber, a small-volume chamber can be used, which is particularly useful when it is desired to make ballpoint pens of small size.

Several embodiments of the present invention will be described hereinbelow with reference to the attached drawings wherein:

Figures 1, 2 and 3 are lengthwise sections of a ballpoint pen according to the invention in the writing position, the rest position, and an intermediate position, respectively.

Figures 4 and 5 are lengthwise sections of a second embodiment of a

ballpoint pen according to the invention, in the writing position and rest position, respectively.

Figures 6 and 7 are partial sections of two means providing a seal between the refill and the pen body.

5 Figure 8 is a partial section showing a means of activating the device according to the invention.

Figure 9 is a partial section of an alternative means of causing the chamber of the device according to the invention to communicate with the atmosphere.

10 In Figures 1 to 3 the body 1 of a ballpoint pen of the invention has a hollow interior housing an ink refill 3 ending in a writing tip such as a nib 5. The interior of the body 1 is in communication with the external ambient atmosphere.

A hollow cylindrical envelope 9, attached to the inside of the pen body, defines therein a cylindrical chamber 7, provided at one end with an axial opening 13 for passage of the nib 5 and at the other end with an axial opening 15 for passage of part 17 of the refill 3. Sealing between these two parts of the refill and cylindrical envelope or casing 9 is provided by two O-rings 14 and 21.

20 Refill 3 is provided with two pressurization orifices 23, communicating via ducts, not shown in the drawing, with the gas-filled space between the end of the refill remote from the writing tip 5 and the ink in the refill.

25 A recess or groove 10 is provided on the exterior of portion 17 of the refill 3.

In Figure 1, the refill is in the writing position and groove 10 is inside chamber 7. The latter is isolated from the ambient atmosphere by O-rings 14 and 21 and the same therefore applies to orifices 23 of refill 3.

30 The volume of chamber 7 is such that, in this position, the pen can accomplish a given length of writing with no notable pressure drop which could otherwise impede ink flow.

However, the user can leave the pen in the writing position without risking substantial ink evaporation, since this is limited by the relatively restricted volume of air in chamber 7.

35 In Figure 2, nib 5 is retracted, groove 10 is inside the pen body, and chamber 7 is once more isolated from the ambient atmosphere, as are

orifices 23, by O-rings 14 and 21. Evaporation of the ink is thus also limited.

In the intermediate position illustrated in Figure 3, groove 10 is opposite O-ring 21 and a passage is thus formed, enabling chamber 7 to communicate with the external ambient atmosphere via the interior of the pen body 1.

Thus, every time the refill passes from the rest position to the writing position and vice versa, chamber 7 is placed in communication with the external ambient atmosphere and thus stores a given volume of air at atmospheric pressure.

In Figures 4 and 5, the body of the pen according to the invention is composed essentially of a tube 30 and a writing head 32 attached to the former by a screw thread 34 with interposition of a seal 36.

A refill 38, provided with pressurization orifices 39, is slidably mounted in bores 40 and 42 of tube 30 and head 32.

A valve 44 is fixedly mounted on nib 46 of refill 38 with the interposition of an 'O' ring seal. This valve is provided with a circular groove 48 receiving an O-ring 50. It is able to move, during movement of the refill, inside a cavity 54 provided in the writing head. Bottom 56 of this cavity receives an O-ring 58.

Tube 30 contains a cylindrical cavity 60, in communication with cavity 54. An O-ring 62 provides a seal between refill 38 and tube 30.

As shown in Figure 4, when a force F is exerted on the refill against a compression spring 52 with the aid of means not shown in the drawing, valve 44 comes into contact with seal 56, and the pressurization orifices of the refill are then in communication with the chamber defined by cavities 60 and 54.

Such an arrangement thus permits a large part of the dead volume of the pen interior to be used to form the chamber controlling the pressure inside the refill.

As shown in Figure 5, when no force is acting on the refill, spring 52 applies seal 48 of valve 44 against the body of the pen. Pressurization orifices 39 are then inside cavity 60. It is found that in this position the volume of the chamber is considerably reduced since it is limited to this cavity 60 alone.

Ink evaporation in the rest position is thus considerably reduced.

It will be noted however that it would be possible further to reduce ink evaporation by giving cavity 60 a smaller volume.

In Figure 6 the seal between refill 38' and pen body 70 is provided by an elastic bellows 72.

5 The base 74 of the latter is attached in a sealed fashion to body 70 and its top 76 comes into contact with bottom 78 of refill 38'.

End 82 of a pushbutton, actuated by means not shown in the drawing, permits the refill to be maintained in the writing position by acting in the direct of force F.

10 This bellows 72 ensures a perfect seal between body 70 and the refill by permitting virtually frictionless axial displacement of the latter. Moreover, the flexibility of this bellows is such that it enables the pressure differences likely to form between the chamber and the ambient atmosphere to be offset.

15 Of course, as shown in Figure 7, the bellows can also be disposed at the writing tip 46' end of the pen.

In this figure, a bellows 72' is attached by its base 74' to tube 30' with the aid of writing head 32'.

20 The end 76' of bellows 72' is traversed in an airtight manner by nib 46'.

Means designed to control the venting of chamber 60' to atmosphere are then provided in the end of the pen remote from the nib 46' end.

25 These means can be, for example, those shown in Figure 9. A cylindrical cavity 54' is provided in the end of body 70' of the pen remote from the nib end. The two lateral faces 86 and 88 of this cavity are provided with sealing O-rings 90 and 92, respectively.

A valve 94 is attached to the end 78' of the refill remote from the nib end.

30 In the rest position (in the absence of force F), a spring 96 applies valve 94 against seal 90. Cavity 54', and chamber 60', are thereby sealed from the external ambient atmosphere but in communication via the pressurization orifices of the refill (not represented in this drawing) with the gas-filled space in the refill between the ink and the refill end remote from the nib 46', and ink evaporation is hence limited.

35 In the writing position (when an opposing force F compresses the

spring maximally), valve 94 comes into contact with seal 92. The chamber 60' is then isolated from cavity 54' which is in communication with the external atmosphere.

5 During passage from the rest position to the writing position the valve is in the position illustrated in Figure 9n and the chamber 60' is in communication with ambient external atmosphere and becomes filled with air at this pressure.

Of course, movement of the refill can be accomplished by any sliding element.

10 As shown in Figure 8, movement of the refill between the rest and writing positions can be produced by a rotary action. A cap 100 is rotatably mounted on the body 102 of a pen. A screw 108 is screwed into the body thereof and comes to rest on bellows 110 in contact with refill 112. This screw 108 comprises a toothed crown 106 whose teeth engage grooves 104 in
15 the cap.

Any rotation of cap 100 causes rotation of screw 108 and hence its lengthwise movement and, as a consequence, lengthwise movement of refill 112.



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CLAIMS

1. Ballpoint pen of the type comprising an ink refill slidably mountable in the interior of a body of the pen for movement between two endmost positions, namely a rest position in which a writing tip is retracted into the body of the pen and a writing position in which said tip projects outside the body of the pen, which refill is of the type comprising in the vicinity of the writing tip at least one orifice adapted to supply the refill with air, wherein the pen has a chamber provided between a casing integral with the body of the pen and a refill when present therein, which chamber is sealed against the ambient atmosphere both in the rest position and in the writing position, the refill orifice opens into the chamber when the refill is present in the pen and means are provided for placing this chamber in communication with the ambient atmosphere every time that the refill passes from the rest position to the writing position, there being ducts provided for connecting the refill orifice in the vicinity of the writing tip with a gas filled space in the refill between the ink and the end of the refill remote from the writing tip, and the pen body interior is in communication with the external ambient atmosphere.
2. Pen according to Claim 1, in which the chamber sealed from the ambient atmosphere is closed, at one of its ends, by means providing sealing between the refill and the body of the pen while permitting relative lengthwise movement between the pen body and refill and, at its other end, closed by closure means incorporating said means for placing this chamber in communication with the ambient atmosphere.
3. Pen according to Claim 2, in which the means providing sealing between the refill and the body of the pen is provided by an O ring fitted into one of these two parts.
4. Pen according to Claim 2, in which the sealing means between the refill and the body of the pen is provided by a bellows whose top is sealingly fixable to the refill.
5. Pen according to any one of the Claims 2 to 4, in which the closure means is a seal fitted into the body of the pen and through which the refill passes sealingly, and the means for placing the chamber in communication with the ambient atmosphere^{is} a groove formed in the refill, this groove being disposed so that, with the refill in the pen and in the writing position, it is in



communication exclusively with said chamber, in the rest position it is exclusively in communication with the ambient atmosphere and in an intermediate position it is in communication both with said chamber and with the ambient atmosphere, said groove allowing the passage of air past the seal in said intermediate position.

6. Pen according to any one of Claims 1 to 4, in which the means for placing the chamber in communication with the ambient atmosphere are formed by a valve integral with the refill, this valve being movable inside a cavity, a first end of which is in communication with the atmosphere and the other end of which is in communication with said chamber, and this valve being disposed so that it cuts off the communication of said chamber with the ambient atmosphere, in the rest position and in the writing position and establishes it during passage from one of these positions to the other.

7. A ballpoint pen substantially as hereinbefore described with reference to Figures 1 to 3, Figures 4 and 5, Figure 6, Figure 7, Figure 8 or Figure 9 of the accompanying drawings.
