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BALL POINT RESERVOIR

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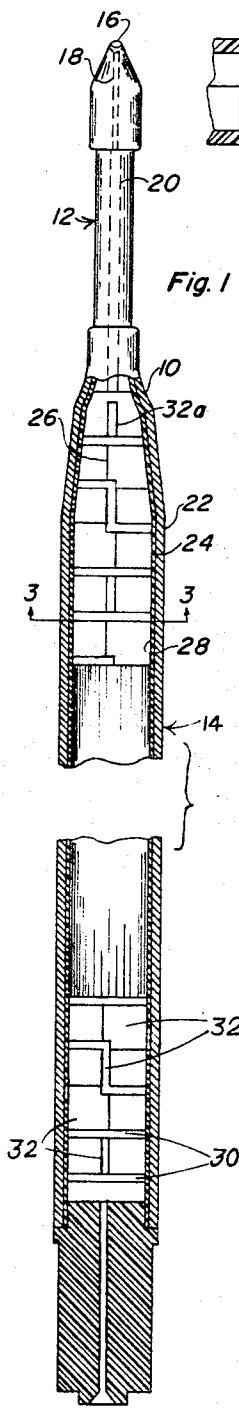

Fig. 1

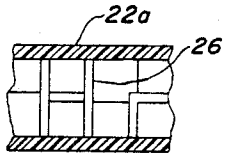

Fig. 5

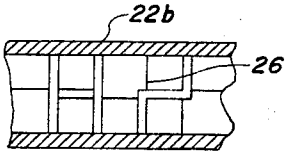

Fig. 6

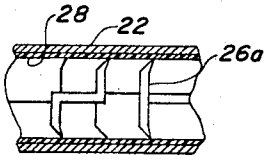

Fig. 7

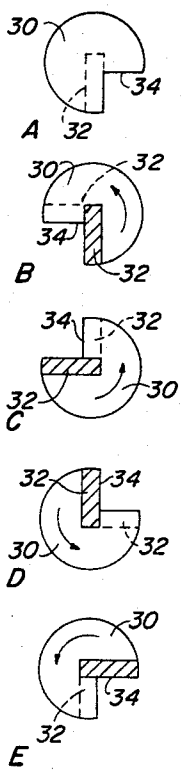

Fig. 4

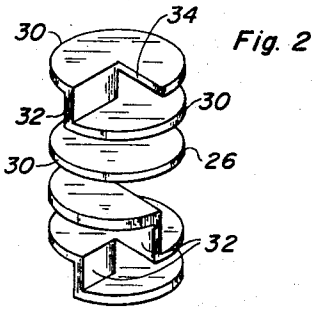

Fig. 2

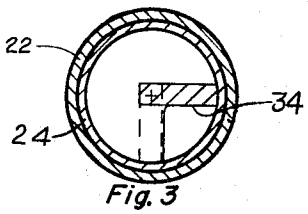

Fig. 3

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BALL POINT RESERVOIR

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ABSTRACT OF THE DISCLOSURE

A ball point pen reservoir comprises a ball point writing tip, a tube connected to the tip and an insert disposed in the tube and cooperating with the inner wall of the tube to form a continuous, serpentine capillary passageway extending from the writing tip to a location near the rear end of the tube for the ink contained in the reservoir. The insert comprises a series of generally circular walls which are interconnected by a series of longitudinally extending spacer walls. Each circular wall includes an aperture located adjacent one side of the two adjacent spacer walls, which extend from opposite sides of the circular wall.

The present invention relates in general to reservoirs for ball point pens, and it relates more particularly to a capillary reservoir which has a large ink capacity relative to the overall length of the reservoir.

The very early ball point pens utilized a relatively large diameter tubular reservoir having sealing means at the rearward end thereof for preventing the ink from flowing out of the reservoir when it was in a horizontal or inverted position. These early reservoir constructions did not operate satisfactorily under the conditions normally encountered by writing instruments, and the first truly successful ball point pen employed what has become known as a capillary reservoir. This type of reservoir has a sufficiently small cross-sectional area that even though the rearward end is open to the atmosphere the ink remains in the reservoir irrespective of its orientation. Although this type of reservoir had the disadvantage that a relatively long reservoir was required in order to hold an adequate supply of ink, it did perform satisfactorily. In fact, the capillary reservoir is still in use today in most ball point pens.

In order to increase the ink capacity of a reservoir having a predetermined length which, of course, is limited by the size of the writing instrument with which it is associated, various constructions were made wherein a capillary passageway was arranged along a tortuous path. It was also suggested that a large diameter, non-capillary tube might support the ink which would be held in place by a follower member disposed at the rearward end of the ink column and movable along the tube as the ink was used up. Ball point pens of this general type are also on the market at the present time and for the most part operate satisfactorily. There are, however, certain problems inherently associated with the non-capillary reservoir.

It would, therefore, be desirable to provide a ball pen reservoir which obviates the need for a follower to prevent the ink from leaking out of the rearward end of the reservoir and which has a capacity-to-overall-length ratio much greater than that heretofore provided with capillary reservoirs and comparable to that achieved with the follower type reservoir. Elimination of the follower, and particularly the so-called "grease" follower will avoid many manufacturing and operational problems.

Therefore, a principal object of the present invention is to provide a new and improved capillary type reservoir for a ball point pen.

Another object of the present invention is to provide

a large capacity ball point pen ink reservoir which eliminates the need for a follower to maintain the continuity of the ink vein in the reservoir.

A further object of the present invention is to provide an insert member which may be positioned within a tube to provide a continuous capillary passageway from one end of the insert to the other.

A still further object of the present invention is to provide an insert which may be placed into a tubular reservoir member to convert said tubular member from a noncapillary to a capillary reservoir.

Briefly, the above and further objects are realized in accordance with the present invention by providing a reservoir consisting of a tubular, imperforate member adapted to be connected at one end to a ball point writing tip and having an insert disposed therein and cooperating with the inner wall of the tube to form a continuous, serpentine capillary passageway extending from the writing tip to a location near the rear end of the tube. The insert is so constructed as to be moldable of a shape-retaining plastic material and to occupy a relatively small overall volumetric space in the tube. Preferably, the insert and the inner wall of the tube have low energy surfaces which help to prevent the ink from traveling toward the rear end of the tube.

Further advtantages and a better understanding of the present invention may be had by reference to the following detailed description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a plan view, partly in section and partly broken away, of a ball point pen cartridge embodying the present invention and showing the cartridge in an inverted position;

FIGURE 2 is an isometric view of a portion of an insert used in the embodiment of FIG. 1;

FIGURE 3 is a cross-sectional view of FIG. 1, taken along the line 3—3 thereof, assuming the entire device to be shown therein;

FIGURE 4 is a diagrammatic view showing successive portions of the insert of FIG. 2 and is used to facilitate an understanding of the operation of the present invention;

FIGURE 5 is a fragmentary, sectional view of another reservoir embodying the present invention;

FIGURE 6 is a fragmentary, sectional view of still another embodiment of the present invention; and

FIGURE 7 is a fragmentary sectional view of yet another embodiment of the present invention.

Referring now to the drawings, and particularly to FIG. 1 thereof, there is shown a ball point pen cartridge **10** including a writing tip assembly **12** and a generally tubular ink reservoir **14** suitably connected together as, for example, by swaging. The writing tip assembly **12** is conventional and includes a writing ball **16** rotatably mounted in a socket **18**. A feed tube includes a narrow capillary bore **20** which forms a feed channel for conveying ink from the reservoir **14** to the socket **18** and the ball **16**. In this embodiment of the invention the reservoir **14** is formed by a cylindrical metallic shell **22** having a thin plastic layer or coating **24** on the inner wall thereof and an insert **26** preferably molded of plastic and fitted into the plastic lined shell **22**. As is described more fully hereinafter, the insert **26** cooperates with the substantially cylindrical inner wall **28** of the shell coating **24** to provide a generally serpentine capillary passageway extending from a location near the rear end of the shell **22** to the rear end of the feed channel **20**. The size and shape of this serpentine passageway and the materials by which it is defined cooperate with the ink contained therein to maintain a continuous vein of ink extending from the rear surface of the ink to the socket **18** and thus to the ball **16**.

In order to permit facile assembly of the insert **26** into the plastic-lined shell **22**, the insert **26** is an integral, shape-retaining member having an envelope which is complementary to the inner wall **28**. The insert **26** may thus be separately molded and inserted into the plastic-lined shell **22**.

Referring also to FIG. 2, it will be seen that the insert **26** comprises a plurality of mutually parallel disk-like wall sections **30** which lie in planes transverse to the longitudinal axis of the insert and which are connected together in spaced apart relationship by respective ones of a plurality of imperforate, radially directed wall sections **32**. Adjacent ones of the radial wall sections **32** are mutually displaced by an angle of 90-degrees and when considered in a direction from front to rear, succeeding ones of the radial wall sections **32** are displaced in a counterclockwise direction. The cut-outs and radial wall sections could, however, progress in a clockwise direction if desired.

Irrespective of the diection in which the cut-outs progress, the resulting structure provides a generally helical reservoir from which substantially all of the ink drains out during writing with a minimum amount of residual ink remaining between the walls **30**.

The spaces between adjacent ones of the transverse, circular wall sections **30** are interconnected by generally triangular cut-out portions **34**. The cut-outs **34** are defined by a pair of edges which intersect at an angle of 90-degrees and extend to the periphery of the transverse wall section. These cut-outs extend from a location near but spaced from the center of the associated circular wall section **30** with one edge thereof adjacent to the next lower radial wall section **32** and one edge adjacent to the next rearward or upward radial wall section **32**. As shown in FIG. 1, the rear end of the insert **26** is formed by a transverse wall section **30** and the front end is formed by a radial wall section **32***a* which is spaced from the rear end of the feed channel **20**. It may thus be seen that a serpentine passageway is provided which extends from the cut-out **34** in the rearmost transverse wall section **30** through the space between that transverse wall and the next succeeding transverse wall, around the radial wall and down through the next cut-out **34** into the space between the next two transverse wall portions, around the next radial wall portion into the next cut-out **34**, etc. In order to eliminate high capillary corners, it is preferable that all corners be filleted.

Referring to FIG. 4, FIG. 4A is a view looking at the rear end of the insert **26** and shows the rearmost transverse wall **30** wherein the cut-out **34** extends from approximately 0-degree to 270-degrees, one edge being coextensive with the right wall of the rearmost radial wall section **32**. FIG. 4B shows the next succeeding transverse wall section **30** wherein the cut-out **34** extends from approximately 180-degrees to approximately 270-degrees between the left-hand side of the rearmost radial wall section **32** and the downward side of the next succeeding radial wall section **32**. Ink travels along the top surface of this wall **30** in the direction of the arrow.

FIG. 4C is a view looking toward the upper side of the third from the rearmost transverse wall section **30** and shows the cut-out **34** extending from approximately 90-degrees to approximately 180-degrees between the upper and left-hand sides, respectively, of the two adjacent radial wall sections **32**. The arrow shows the direction of ink flow which is counterclockwise.

FIG. 4D is a view of the fourth from the rearmost wall section **30** and shows the cut-out **34** located between 0-degree and 90-degrees with the arrow indicating that the ink flows in a counterclockwise direction along the rear surface of this wall **30**.

FIG. 4E shows the fifth from the rearmost transverse wall section **30** to be the same as the rearmost wall section of FIG. 4A, i.e., the cut-out **34** extends from 0-degree to approximately 270-degrees. The orientation of the next succeeding transverse wall sections and radial wall sections continue in the same sequence as indicated by FIGS. 4A through E, inclusive.

In order to provide the necessary rigidity to permit insertion of the insert **26** into tight fitting relationship with the inner wall **28** of the shell, the radial wall sections **32** overlap by a dimension equal to the thickness of the wall sections **32** to provide an insert having a rodlike central core which is square in cross section and supports the compressive load exerted on the insert during the insertion operation.

It is common practice to taper the forward end of a ball point reservoir and the reservoir **14** is constructed in this known manner. Consequently, the forward portion of the insert **26** and more particularly the wall portions **30** and **32** at the forward portion thereof define an envelope which is complementary to the taper of the surface **28** at the forward end of the shell. Moreover, the front end of the insert **26** terminates in a radial wall section which is spaced from the rear end of the feed channel **20** so that ink may feed from the reservoir into the feed channel.

To eliminate the possibility of ink moving rearwardly in the reservoir under the force of gravity or because of capillary creep, it is preferred that the insert **26** be formed of a material having a low energy surface such, for example, as Teflon, or that the insert be formed of some other material and coated with a low energy surface material. Likewise, it is preferred that the inner wall **28** have a low energy surface and in the embodiment shown in FIG. 1 this is accomplished by coating the inner wall of the metallic shell **22** with a low surface energy material **24**.

In the embodiment of FIG. 1, the shell **22** is formed of metal lined with a plastic layer **24**. If desired, and as shown in FIG. 5, the entire shell **22***a* may be formed of a plastic having a low energy surface. Under some circumstances, and as shown in FIG. 6, the shell **22***b* may be formed of metal throughout—no plastic inner lining being provided. In this case, however, it is preferable that a seal or a tight fit be provided between the wall sections of the insert and the inner wall of the shell **22***b*.

In order to facilitate the manufacture of the insert so that a wider range of dimensional tolerances may be used, as shown in FIG. 7 the outer edges of the wall sections **30** and **32** may be tapered or feathered and the overall envelope diameter of the insert made slightly larger than the internal diameter of the shell **22**. With this construction, as the insert **26***a* is pressed into the shell **22**, the resilient edges of the wall sections are bent toward the rear and when the insert is in place the inherent memory of the material from which the insert **26***a* is molded causes the walls to move toward their originally molded position thereby providing a tight sealing fit between the wall sections and the inner wall **28** of the shell **22**. If desired, this aspect of the invention may be utilized by molding the insert **26** in the shape shown in FIG. 2 but having a slightly larger diameter than the internal diameter of the shell with which it is to be used. Prior to assembly of the insert **26** into the tube, the outer edges of the insert are treated with a chemical to render them soft and pliable during the insertion operation.

The insert **26** may be formed of any shape-retaining material, such, for example, as metal but preferably it is molded of plastic. Accordingly, it may be formed of polyethylene, polypropylene, Teflon or other suitable plastic which has sufficient strength to retain its shape during assembly and use and which occupies a relatively small total volume in the reservoir. Using polypropylene, it has been found that an insert having the following dimensions has a volume about the same as that of a grease follower replaced by the insert.

	Inches
Insert length	2.25
Insert diameter	.213
Axial length of wall **32**	.125
Thickness of wall **30**	.025
Thickness of wall **32**	.025

While the present invention has been described in connection with particular embodiments thereof, it will be understood that those skilled in the art may make many changes and modifications without departing from the teachings of the present invention. Therefore, in the appended claims it is intended to cover all such changes and modifications as come within the true spirit and scope of this invention.

We claim:

1. An insert for disposition in a tubular ink reservoir member of a ball point pen to provide a generally serpentine capillary passageway extending from one end of said tubular member which is open to the atmosphere to the other end of said tubular member which is connected through a feed channel to a writing ball, said insert comprising

a member having a plurality of parallel, transversely extending walls and a plurality of longitudinally extending spacer walls respectively disposed between adjacent ones of said transverse walls,

said transverse walls having a shape generally complementary to said tubular member and said spacer walls extending inwardly from the marginal edges of the adjacent transverse walls,

said transverse walls each being provided with an aperture located adjacent to one side of the two adjacent spacer walls, and

the apertures adjoining each of said spacer walls being disposed on opposite sides thereof

whereby ink placed in said reservoir occupies a serpentine passageway from the open end of which ink will not flow under the force of gravity.

2. An insert according to claim **1** wherein said transverse walls are generally circular, and said apertures are disposed at the edges of said transverse walls.

3. An insert according to claim **2** wherein said transverse walls are mutually parallel.

4. An insert according to claim **2** wherein said apertures extend to approximately the center line of said insert and are in the shape of a 90-degree segment of a circle.

5. An insert according to claim **1** wherein said spacer walls each lie in a radial plane, and successive ones of said spacer walls are displaced from one another by an angle of about 90-degrees.

6. An insert according to claim **1** wherein said insert is formed of a rigid plastic material.

7. An insert according to claim **1** wherein said insert is formed of metal.

8. An insert according to claim **2** wherein the peripheral edges of said walls define a cylinder having a diameter slightly greater than the internal diameter of said tubular member, and

the peripheral edges of said walls are flexible so as to deflect as said insert is pressed into said tubular member,

whereby a tight fit is provided between the walls of said insert and said tubular member.

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LAWRENCE CHARLES, *Primary Examiner.*

U.S. Cl. X.R.

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