



# UNITED STATES PATENT OFFICE

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## FOUNTAIN PEN

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This invention relates to fountain pens of the self-filling type.

An object of my invention is to provide a fountain pen which has a large ink capacity and which does not depend for its filling action upon any mechanical filling device.

A further object of my invention is to provide a fountain pen which is inherently free from ink leakage when subjected to relatively rapid changes of temperature or atmospheric pressure.

A further object of my invention is to provide a fountain pen which will not be subject to drying out during periods of non-use and will feed the ink or writing fluid to the writing nib promptly at all times and under all conditions of use.

Further objects and advantages of my invention will be understood from the following detailed description in conjunction with the accompanying drawings in which:

Figure 1 is a longitudinal sectional view of a fountain pen embodying my invention;

Figure 2 is a transverse sectional view taken on line 2—2 of Figure 1;

Figure 3 is an enlarged transverse sectional view taken on line 3—3 of Figure 1;

Figure 4 is an enlarged fragmentary view of the rear ends of the capillary tubes;

Figure 5 is a view similar to Figure 3 showing a modified arrangement for providing the longitudinal ink-carrying capillary passages;

Figure 6 is a fragmentary longitudinal sectional view of the front end portion of a modified embodiment of my invention; and

Figure 7 is a side perspective view of a wick ink feed member employed in the modification shown in Figure 6.

Referring more in detail to the drawings:

The barrel 10 is a hollow elongated tubular member and may be of any desired cross-sectional shape; however, in the embodiment shown the barrel is circular. The front end of the barrel is adapted to receive a conventional type of closure cap 11 provided with a clip 12. The cap may be secured to the barrel by means of threads 13 or by frictional engagement, as desired. The rear end of the barrel 10 is closed by a removable cap 14 which, in the embodiment shown, is secured thereto by threaded engagement with the threaded end 15 of a tubular member 16 which extends into the barrel 10 and is embraced by the inner wall of the barrel in close fitting frictional engagement therewith. Preferably, the barrel 10 is counterbored to receive the member

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16 and the latter is of the same interior diameter as the normal diameter of the barrel.

The front end of the barrel 10 is provided with a removable sheath member 17 which engages the interior of the barrel in close fitting frictional engagement, the portion extending into the barrel being preferably of reduced diameter in order to avoid any offset between the exterior of the barrel 10 and the sheath 17. If desired, the sheath may be secured to the barrel by threaded engagement therewith. The member 17 functions as an extension of the barrel and as a guard for the writing nib 18. The nib 18 is of conventional type, being provided with a writing tip 19 and the usual ink slit (not shown) extending from the tip back a substantial distance toward the rear of the nib 18. The nib 18 is secured in close frictional engagement between the sheath 17 and the feed member 20. The feed member 20 is provided with conventional transverse slots 21 to form a suitable "comb" arrangement for holding any excess ink. The exterior of the feed member 20 is preferably relieved as indicated at 22 to receive the rear portion of the writing nib 18. The sheath is offset at 23 in order to provide a guard portion 24 spaced from the nib 18. The feed member 20 engages the interior of the sheath 17 in close fitting frictional engagement.

The interior of the barrel 10 is filled with a large number of small tubes 25 which are longitudinally disposed within the barrel. These tubes 25 extend throughout the length of the ink chamber portion of the barrel 10, the tubes at their rear ends terminating adjacent a metallic screen guard 26 or other suitable perforated guard member, and the tubes 25 at their front ends terminate at a point adjacent the front end of the barrel 10, preferably just short of the sheath member 17. The tubes 25 are of an interior diameter such that each of them functions as a capillary longitudinal passage. The tubes 25 may be of glass, metal, plastic or any other suitable material.

The interior of the barrel 10 is provided with a tube 27, the rear end of which terminates beyond the outer side of the screen guard 26 and the front end of which opens into a passage 28 in the feed member 20, the passage 28 being provided with a vent 29. The tube 27 has an interior diameter which is sufficient that it will not materially function as a capillary passage. By means of this arrangement the pressure in the rear of the barrel 10 is always the same as the pressure in the front end of the barrel and such pressure equality is constantly maintained irrespective of

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sudden changes in temperature or atmospheric pressure.

Each of the tubes 25 should have an interior diameter such that when one end is dipped into a supply of ink a capillary action will result whereby the ink will flow into the tube and substantially completely fill it within a reasonably short interval of time. However, the diameter of the tubes should be sufficiently large to permit the flow of ink from the tubes when the pen is in use. With tubes of too small diameter, or in some instances substantially all, of the ink will remain in the tubes as the capillary action may be so strong as to tend to "lock" the ink within the tubes.

In order to avoid possible "locking" of ink in the tubes, particularly because of air bubbles, and to insure that substantially all of the ink will flow from the tubes 25 to the writing nib 18, I have found it desirable to extend throughout the length of each tube 25 a small thread 30 of fibrous material. It is preferred to extend each length of thread from the front end of each tube 25 and converge them into a mass or bundle 31 which is carried in a suitable channel 32 provided in the upper side of the feed member 20 and extending along the under side of the writing nib 18 and terminating just short of the writing tip 19. By this arrangement the ink will flow along the fibres of the threads to the writing nib, the capillary action of the threads assuring that the flow will continue until the supply of ink in the tube 25 is substantially exhausted. The threads 30 may be made of any suitable fibre; however, I prefer to employ a non-absorptive type of fibre such as "nylon," glass or the like.

Practice has demonstrated that satisfactory results have been obtained employing glass tubes having an interior diameter of from about 0.013 to 0.018 inch and a 40 fibre "nylon" thread of about 40 denier.

In the embodiment shown, the threads 30 are longer than the minimum length necessary to extend throughout the length of the channel 32 of the feed member 20, whereby when the pen is in assembled condition, the extra length of the threads results in sufficient "bunching" of the threads, as shown at 36 of Figure 1, to cause the threads to substantially fill the enlarged space between the ends of the tubes 25 and the channel 32, thus assuring sufficient capillary action to cause substantially all of the ink to flow from the tubes 25 into and through the channel 32.

It is to be understood that the longitudinal capillary passages in the barrel 10 may be formed by suitable means other than the tubes 25. For example, these capillary passages may be formed as shown in Figure 5. In this particular embodiment the capillary passages 35 are formed by rolling together two sheets of suitable material, such as plastic, thin metal or the like, one of the sheets having a smooth even surface and the other being transversely undulated or corrugated to form, in cooperation with the even surfaced sheet, the capillary passages 35. Each passage 35 is provided with a thread 30 which may be placed in position during the rolling process.

Since a fountain pen built in accordance with my invention is inherently capable of adapting itself to sudden changes of atmospheric pressure, the caps 11 and 14 may engage the barrel 10 in an air tight manner, both of the caps 11 and 14 being ventless, whereby the interior of the pen is completely sealed. Thus, even though the pressure within the pen may be materially differ-

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ent from that of the surrounding atmosphere, upon either cap being removed, the pressure in the opposite end of the barrel will, by reason of the free communication provided by tube 27, immediately change so as to be equal to that at the end from which the cap has been removed.

In the operation of the pen hereinabove described, the rear cap 14 is removed and the rear end of the barrel is dipped into a supply of ink. Any air trapped in the open end 15 of tubular member 16 escapes through holes 40 as the end 15 enters the body of ink. The barrel is dipped into the ink to a sufficient depth to cause the ink to come into communication with the open rear ends of the tubes 25 whereupon the ink will flow upwardly into the tubes by capillary action. During the filling operation, it is desirable that the front cap 11 be removed. After the necessary time interval to permit the filling of the longitudinal ink passages, the cap 14 is restored and the pen is ready for use. The capillary action of the threads 30 is such as to assure a prompt and constant flow of ink from the longitudinal capillary ink passages in the barrel 10 to the writing nib 18.

Figure 6 shows a modified arrangement in which the tubes 25 are not provided with any threads. In order to assure the flow of substantially all of the ink from the front ends of the tubes 25 to the writing nib 18, the channel 32 of the feed member 20 is filled with fibrous material 37 which may comprise a unitary piece of wicking as shown in Figure 7, the rear end portion of which is suitably flared at 38 to substantially fill the space between the ends of the tubes 25 and the channel 32. The flared end 38 of the wick member preferably abuts the open ends of the tubes 25. By this arrangement, the ink is carried by capillary action from the ends of the tubes 25 through the wick member to the writing nib 18.

Obviously, my invention is capable of many other specific embodiments in addition to those described above.

Where the expressions "greater capillarity" or "lesser capillarity" are used herein, it will be understood that they refer to the relative abilities of various passages to lift a column of liquid by capillary action. That is, the statement that one passage has a greater capillarity than another passage will be understood to describe a passage having such capillary characteristics that it will lift a column of a given liquid to a greater height above the level of a supply of liquid with which the end of the passage is in communication than will the second passage when under identical conditions.

I claim:

1. A fountain pen comprising an elongated hollow barrel, a writing nib carried by one end of said barrel, reservoir means within said barrel for carrying a supply of ink, said last-named means comprising a plurality of separate and distinct capillary passages extending throughout a substantial portion of the interior of said barrel and being substantially longitudinally disposed therein and substantially parallel to the axis thereof, each of said passages having a transverse dimension providing a passage of sufficient capillarity to draw ink into the passage by capillary action to substantially fill said passage and having a portion extending longitudinally substantially throughout its length of greater capillarity than the remainder of the passage, means for constantly venting said passages to atmosphere, and

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capillary means for feeding ink from said capillary passages to said writing nib.

2. A fountain pen comprising an elongated hollow barrel, a writing nib carried by the front end of said barrel, means within said barrel for carrying a supply of writing fluid, said last-named means comprising a plurality of separate and distinct capillary passages, each said capillary passage extending throughout a substantial portion of the interior length of said barrel and being in communication with the interior of said barrel at their respective ends, a fibrous thread longitudinally disposed within each of said capillary passages and extending throughout a substantial portion of the length thereof, and means within the front portion of said barrel for feeding writing fluid from said capillary passages to said writing nib.

3. A fountain pen comprising an elongated hollow barrel, a writing nib carried by the front end of said barrel, means within said barrel for carrying a supply of writing fluid, said last-named means comprising a plurality of separate and distinct capillary passages, each said capillary passage extending throughout a substantial portion of the interior length of said barrel and being in communication with the interior of said barrel at their respective ends, and means within said barrel for feeding writing fluid from said capillary passages to said writing nib, said feeding means comprising a plurality of fibrous threads extending from the front end portion of said barrel into the front ends of different ones of said capillary passages.

4. A fountain pen comprising an elongated hollow barrel, a writing nib carried by the front end of said barrel, means within said barrel for carrying a supply of writing fluid, said last-named means comprising a plurality of separate and distinct capillary passages, each said capillary passage extending throughout a substantial portion of the interior length of said barrel and being in communication with the interior of said barrel at their respective ends, a fibrous thread longitudinally disposed within each of said capillary passages and extending throughout a substantial portion of the length thereof, each of said threads extending without the front ends of said passages to a point adjacent said writing nib, thereby providing fibrous capillary means for assuring the flow of writing fluid from said passages to said writing nib.

5. A fountain pen comprising a pen casing having an ink reservoir chamber extending throughout a substantial portion thereof, a writing element, means mounting said writing element on said pen casing, capillary filler-and-reservoir means in said chamber, including relatively fixed, rigid walls defining a plurality of capillary cells extending longitudinally substantially throughout said reservoir chamber and having transverse dimensions providing cells of sufficient capillarity to draw ink thereinto to substantially fill said cells when they are placed in filling communication with a supply of ink, each of said cells having an element therein defining a capillary ink feed passage extending longitudinally substantially throughout the length of the cell of greater capillarity than the remainder of the cell, means for constantly venting said cells to atmosphere, and feed means extending from said cells into feeding relation with said writing element.

6. A capillary filler-and-reservoir element for a fountain pen of the type including a pen cas-

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ing having a reservoir chamber, a writing element, means mounting said writing element at the front end of said casing, and means for feeding ink from the filler-and-reservoir element to the writing element, said capillary filler-and-reservoir comprising a plurality of tubular members of capillary cross-sectional dimensions, disposed in parallel side-by-side relation and defining a plurality of capillary cells extending longitudinally of said filler-and-reservoir element, a cross-sectional dimension of each of said tubular members being not greater than that which will produce a capillary rise of ink in said cells to substantially fill them, each of said cells having therein an element of lesser diameter than the cell and extending along the cell to insure continuity of the column of ink in the cell, said capillary filler-and-reservoir element being adapted to be disposed in the reservoir chamber with said capillary cells extending longitudinally thereof and connected to said ink feed means.

7. An ink reservoir for a fountain pen of the type including a pen body having a reservoir chamber, a writing element, means mounting said writing element at the front end of said body, and means for feeding ink to said writing element, said reservoir comprising a plurality of tubular members arranged in telescoped relation and defining therebetween a plurality of capillary cells extending longitudinally of said reservoir and a capillary element in each of said cells providing therein a portion extending longitudinally substantially throughout the length of said cell of greater capillarity than the remainder of the cell, said reservoir being adapted to be disposed in said reservoir chamber with said cells connected to said feed means.

8. A fountain pen comprising a pen casing having a reservoir chamber, a writing element, means mounting said writing element at the front end of said casing, capillary filler-and-reservoir means in said chamber including wall means defining a plurality of capillary cells each extending longitudinally of said casing and having at least a substantial portion of the cross-section unobstructed, said capillary cells being of sufficient capillarity to draw ink thereinto to substantially fill said cells when they are placed in communication with the supply of ink, means for constantly venting said cells to atmosphere, capillary means in said cells for maintaining the continuity of a body of ink therein, and means connected with said cells for maintaining and feeding a continuous column of ink from said reservoir to said writing element.

9. A fountain pen comprising a pen casing having a reservoir chamber, a writing element, means mounting said writing element at the front end of said casing, capillary filler-and-reservoir means in said chamber including a plurality of tubes disposed in side-by-side relation defining a plurality of capillary cells extending longitudinally of said casing of sufficient capillarity to draw ink thereinto to substantially fill said cells when they are placed in communication with a supply of ink, capillary means in each tube extending longitudinally of the cell substantially throughout its length and of greater capillarity than the remainder of the cell for maintaining continuity of the column of ink in said cell, and capillary feed means of greater capillarity than said cells for feeding ink from said cells to said writing element.

10. A fountain pen comprising a pen casing having a reservoir chamber, a writing element,

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means mounting said writing element at the front end of said casing, capillary filler-and-reservoir means in said chamber including a plurality of tubes disposed in side-by-side relation and defining a plurality of capillary cells extending longitudinally of said casing, and of sufficient capillarity to substantially fill by capillary action, and capillary means in said tubes providing a predetermined ink feed path extending throughout the length of each cell of greater capillarity than in the remainder of said cell and sufficient to maintain the continuity of the body of ink in the cell, said last means extending beyond the ends of said tubes to provide capillary means for feeding ink from said filler-and-reservoir means to said writing element.

11. In a fountain pen of the type including a pen body having a reservoir chamber and a feed section, a writing element and means mounting said writing element at the front end of said body, the combination of an ink reservoir adapted to be disposed in said chamber and including means defining a plurality of substantially separate and distinct capillary cells each of a length adapted to extend longitudinally throughout a substantial portion of said chamber and ink feed means adapted to be disposed in said feed section and including a fibrous wick of greater capillarity than said cells extending from said cells and adapted to be placed in feeding relation to said writing element.

12. A fountain pen comprising a pen body, a writing element, means mounting said writing element at the front end of said body, an ink reservoir in said body including means defining a plurality of capillary cells each extending longitudinally throughout a substantial portion of said body, and ink feed means of greater capillarity than said cells and including a fibrous filament extending from each of said cells into feeding relation with said writing element.

13. A fountain pen comprising a pen body, a writing element, means mounting said writing element at the front end of said body, an ink reservoir in said body including a plurality of capillary cells extending longitudinally of said body, and a wick in feeding relation with each of said cells and extending substantially throughout said reservoir and into feeding relation with said writing element.

14. A fountain pen comprising a pen body, a writing element, means mounting said writing element at the front end of said body, an ink reservoir in said body including means defining a plurality of capillary cells extending longitudinally of said body and open at the front and rear of said pen, each of said cells having capillary means associated therewith defining an ink feed passage extending longitudinally substantially throughout the cell of greater capillarity than the remainder of the cell, means for feeding ink from said reservoir to said writing element and means including an air passage extending throughout said reservoir for equalizing the air pressure at the front and rear ends of said cells.

15. A fountain pen comprising a pen body having an ink reservoir chamber, a writing element, means mounting said writing element at the front end of said pen body, capillary filler-and-reservoir means in said chamber including a plurality of capillary cells each extending longitudinally throughout said reservoir, each of said cells having a transverse dimension providing a cell of sufficient capillarity to draw aqueous ink thereinto to substantially fill said cells when said cells

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are placed in communication with a supply of ink and to retain the ink therein by capillary action except when the pen is used in writing, capillary feed means connecting said reservoir means with said writing element, and means at the rear end of said pen for placing said cells in capillary filling relation with a supply of ink.

16. A fountain pen comprising a pen body, a writing element, means mounting said writing element at the front end of said body, an ink reservoir in said body including means defining a plurality of capillary cells extending longitudinally of said reservoir, each of said cells having a transverse dimension providing a cell of sufficient capillarity to draw ink thereinto to substantially fill said cells when they are placed in communication with a supply of ink, said cells having filling openings at their rear ends for placing them in capillary filling relation with a supply of ink and feeding openings at their front ends, removable closure means for closing the rear ends of said cells and which when removed exposes the rear ends of said cells for filling, and feed means extending from the front ends of said cells into feeding relation with said writing element.

17. A capillary filler-and-reservoir element for a fountain pen of the type including a casing having a feed section and a reservoir section extending rearwardly from said feed section and defining a vented reservoir chamber, a pen nib at the forward end of said casing and capillary ink feed means connected to said nib, said capillary filler-and-reservoir element adapted to be disposed in said chamber to provide the principal ink storage means of said pen and including wall means defining a plurality of separate and distinct, elongate ink storage spaces disposed in side-by-side relation and extending longitudinally of said element and of the chamber when said element is disposed therein, at least one transverse wall-to-wall dimension of each space being such as to provide a capillarity sufficient to draw in ink to fill said space and to retain the ink therein by capillary action but insufficient to retain the ink against withdrawal in writing, at least one elongate portion of each of said spaces providing a greater capillarity than other portions, said spaces being open at their rearward portions for communication with the chamber.

18. A fountain pen comprising a casing having a reservoir chamber, a writing element at the forward end of said casing, capillary filler-and-reservoir means in said chamber including a corrugated thin-walled member and a relatively smooth thin-walled member disposed in face-to-face relationship to define therebetween a plurality of elongate capillary ink storage spaces extending in parallel, side-by-side relation longitudinally of said chamber and capillary ink feed means connecting said spaces in ink feeding relation with said writing element.

19. A fountain pen comprising a pen casing having a feed section and a reservoir section defining a reservoir chamber, a writing element at the forward end of said casing, a capillary filler-and-reservoir element in said chamber including a plurality of tubular partition members disposed in telescoping arrangement and a corrugated tubular partition member interposed between and spacing said tubular members and defining therewith a plurality of elongate capillary spaces arranged in side-by-side relation and extending longitudinally of said chamber, capil-

lary means in said spaces for maintaining the continuity of the columns of ink therein, and capillary ink feed means in said feed section connecting said ink storage spaces in ink feed relation with said writing element.

20. A fountain pen comprising a pen casing having a feed section and a reservoir section defining a reservoir chamber, a writing element at the forward end of said casing, a capillary filler-and-reservoir element in said chamber including a plurality of generally cylindrical, relatively smooth-walled partition elements disposed in radially spaced, substantially concentric arrangement and a corrugated spacer element of generally annular form interposed between said partition elements with the corrugations thereof abutting said partition elements, said partition elements and said spacer element defining therebetween a plurality of elongate capillary ink storage spaces arranged in parallel side-by-side relation and extending longitudinally of said chamber, and capillary ink feed means in said feed section connecting said spaces in ink feeding relation with said writing element.

21. A fountain pen comprising a casing having a feed section and a reservoir section defining a reservoir chamber, a pen nib having a capillary ink passage, a capillary filler-and-reservoir element including relatively fixed, rigid wall means defining capillary ink storage spaces extending throughout said filler-and-reservoir element and constituting the principal ink storage space of said pen, said wall means having opposed portions spaced apart a distance which will produce a capillary action sufficient to draw ink into said space and to retain the ink therein by capillary action but insufficient to retain the ink against withdrawal in writing, at least one longitudinally extending portion of each of said spaces providing a greater capillarity than other portions, means for constantly venting said storage space to atmosphere, and capillary ink feed means in said feed section including a fibrous wick in ink feeding communication with said portions of greater capillarity and extending to the ink passage in said nib and providing a capillary ink feed connection between said spaces and said passage.

22. A fountain pen comprising an elongated hollow barrel, a writing nib carried at one end of said barrel, reservoir means within said barrel for carrying a supply of ink, said last-named means comprising a plurality of relatively smooth-walled partition elements defining a plurality of separate and distinct capillary spaces extending throughout a substantial portion of the interior of said barrel and being substantially longitudinally disposed therein, each of said spaces having a transverse dimension providing a space of sufficient capillarity to draw ink into the space by capillary action to substantially fill said space, and means disposed between said partition elements and providing in said space a plurality of capillary ink storage cells having at least portions of greater capillarity than said space, means for constantly venting said spaces

to atmosphere, and capillary means for feeding ink from said reservoir means to said writing nib.

23. A fountain pen comprising a casing having a reservoir chamber, a writing element at the forward end of said casing, capillary filler-and-reservoir means in said chamber including a plurality of relatively thin, spaced, wall elements disposed in face-to-face relationship to define therebetween an elongate capillary ink storage space extending longitudinally of said chamber, means disposed between said wall elements spacing the same and dividing the space therebetween into a plurality of capillary cells having at least portions of greater capillarity than said space, and capillary ink feed means connecting said capillary filler-and-reservoir means in ink feeding relation with said writing element.

24. In a fountain pen comprising a pen casing having a feed section and a reservoir section defining a reservoir chamber, a writing element at the forward end of said casing, a capillary filler-and-reservoir element in said chamber including a plurality of longitudinally extending relatively smooth-walled partition elements disposed in spaced face-to-face relation and defining a capillary space therebetween, a spacer element interposed between and abutting said partition elements to maintain the latter in predetermined spaced relationship, said spacer element having a plurality of wall portions serving to define a plurality of capillary ink storage cells within said capillary space substantially throughout the latter, having at least portions of greater capillarity than said space, and capillary ink feed means in said feed section connecting said filler-and-reservoir element in ink feeding relation with said writing element.

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