

May 10, 1960

H. E. MORSE ET AL

2,935,968

SANDWICH FEED TYPE FOUNTAIN PEN

Filed April 12, 1955

3 Sheets-Sheet 1

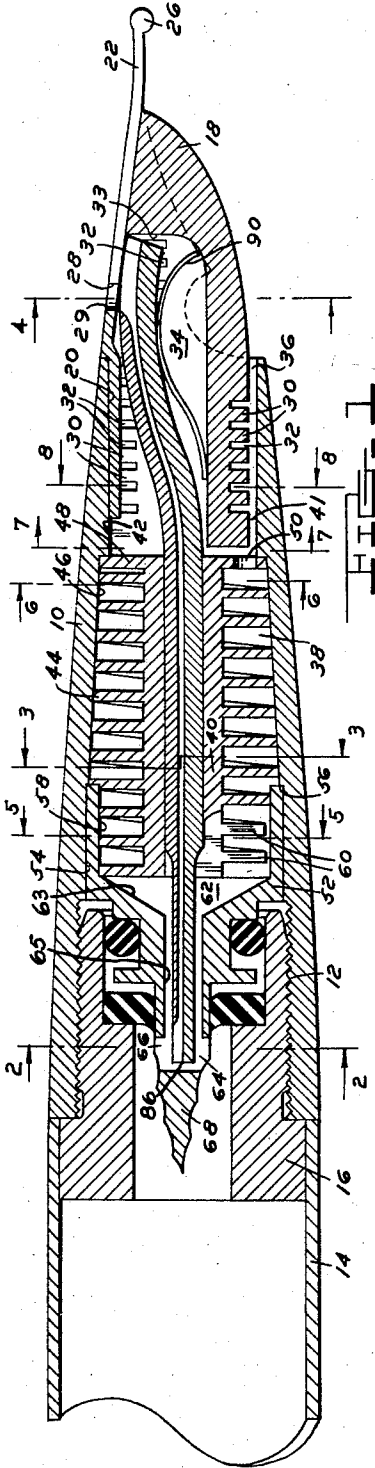
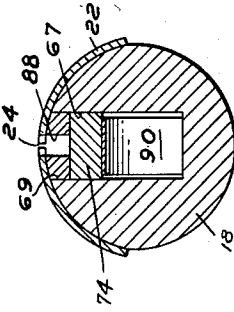


FIG. 4

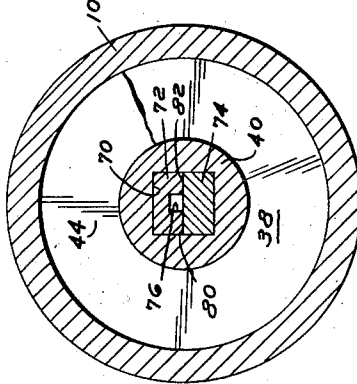


FIG. 5

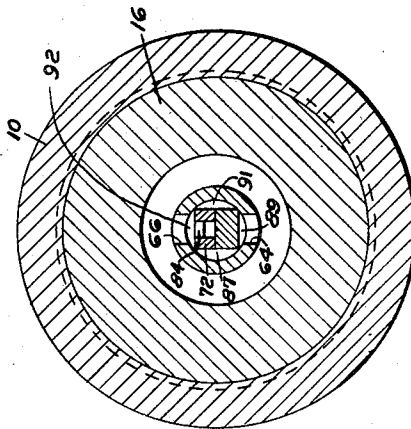


FIG. 6

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3 Sheets-Sheet 2

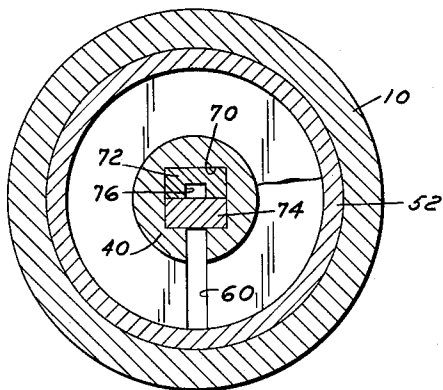


FIG. 5

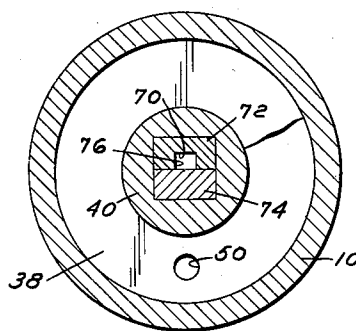


FIG. 6

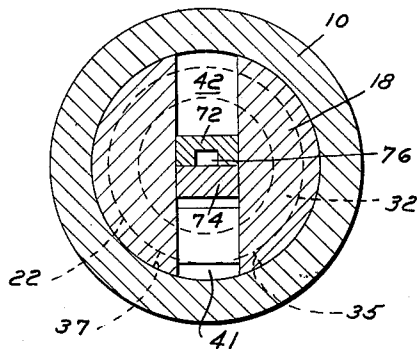


FIG. 7

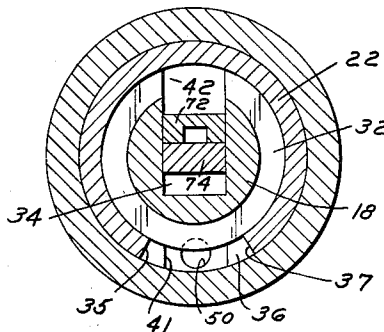


FIG. 8

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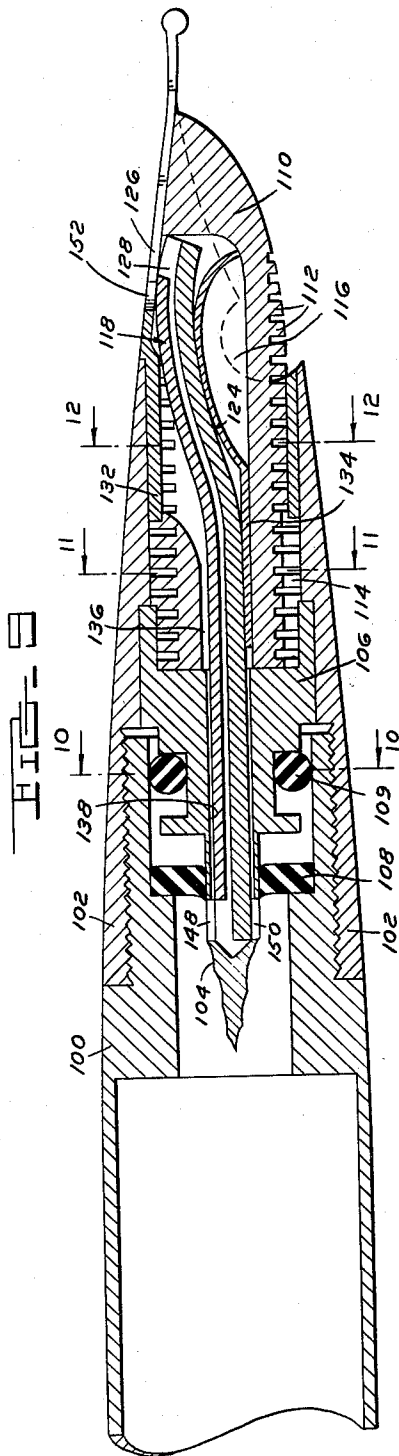
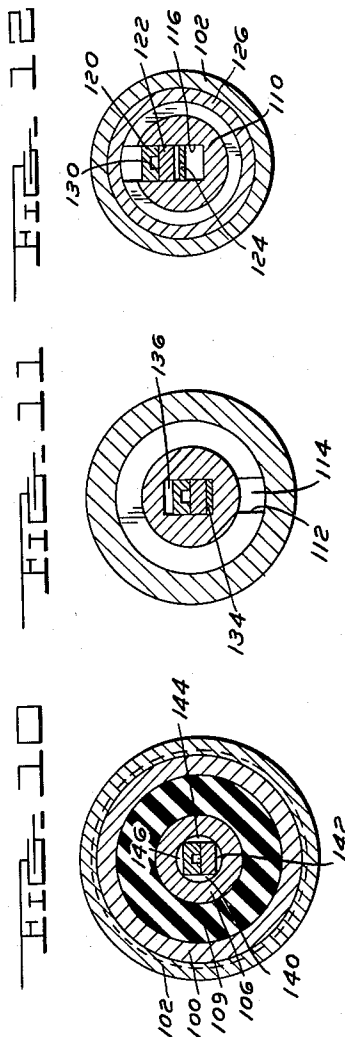
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3 Sheets-Sheet 3



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2,935,968

SANDWICH FEED TYPE FOUNTAIN PEN

Henry E. Morse, Noral A. Nelson, and Clifford H. Springer, Holland, Mich.; said Nelson and said Springer assignors to said Morse

Application April 12, 1955, Serial No. 500,755

3 Claims. (Cl. 120—50)

This invention relates to fountain pens and particularly to an improved ink feed connection between the ink storage compartment and the writing element.

An object of the invention is the provision in a fountain pen of an ink feed duct of capillary dimension communicating at one end with the ink storage compartment and at the other end with the writing element and which is adapted to pass ink therethrough from the ink storage compartment to the writing element, and an ink feed passage of capillary dimension opening into the feed duct throughout substantially the length thereof and which is of greater capillarity than the feed duct and assists the flow of ink from the storage compartment to the writing element through the feed duct.

Another object of the invention is the provision in a fountain pen of means extending from the ink storage compartment to the writing element and which means defines an ink feed duct communicating at one end with the ink storage compartment and at the other end with the writing element, said means also defining an ink feed passage coextensive with the feed duct and opening thereinto throughout the length thereof with said passage adapted to carry ink from the ink storage compartment to the writing element by capillary attraction, and with the flow of ink through said passage adapted to increase the flow of ink through the feed duct.

Another object of the invention is the provision in a fountain pen of means disposed between the ink storage compartment and the writing element, and which means comprises a pair of juxtaposed members defining an ink feed duct communicating at one end with the ink storage compartment and at the other end with the writing element, and with the meeting faces of the members opening into the feed duct and adapted to receive a film of ink between such faces, which film assists and increases the flow of ink through the feed duct from the ink storage compartment to the writing element.

Another object of the invention is the provision in a fountain pen of means disposed between the ink storage compartment and the writing element, which means defines an ink feed duct communicating at one end with the ink storage compartment and at the other end with the writing element, and with that end of said means communicating with the writing element being held resiliently in capillary ink feeding communication with the writing element.

Other objects, advantages, and meritorious features will more fully appear from the specification, claims, and accompanying drawing, wherein:

Fig. 1 is a longitudinal cross sectional view through a fountain pen embodying our invention;

Fig. 2 is a transverse cross sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a transverse cross sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a transverse cross sectional view taken on the line 4—4 of Fig. 1;

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Fig. 5 is a cross sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a cross sectional view taken on the line 6—6 of Fig. 1;

Fig. 7 is a cross sectional view taken on the line 7—7 of Fig. 1;

Fig. 8 is a cross sectional view taken on the line 8—8 of Fig. 1;

Fig. 9 is a longitudinal cross sectional view through the fountain pen embodying a modified form of our invention;

Fig. 10 is a transverse cross sectional view taken on the line 10—10 of Fig. 9;

Fig. 11 is a transverse cross sectional view taken on the line 11—11 of Fig. 9; and

Fig. 12 is a cross sectional view taken on the line 12—12 of Fig. 9.

In carrying out the objects of our invention, we have provided in a fountain pen an improved ink feed communication between the ink storage compartment and the writing element. In Fig. 1 we have shown a fountain pen embodying one form of our invention. The pen shown is of the removable cartridge type and comprises a lower pen body portion 10, generally conoidal in shape, and hollow throughout its longitudinal dimension, with a removable upper body portion or ink storage compartment 14 threadedly coupled thereto as at 12. The ink storage compartment 14 is provided with an insert 16 secured to the inside of the compartment in any convenient manner, and it is to this insert that the lower body is threadedly coupled. The forward end of the lower pen body is adapted to receive an ink feed bar 18 supporting thereupon, and between the bar and the forward opening 20 in the body, a writing element 22. The writing element is provided with a capillary slit 24, shown in Fig. 4, which extends from the nibs 26 back to substantially the point 28. Rearwardly of the point 28, the slit widens out to form a diamond or heart-shaped air intake opening 29, the function of which is explained hereinafter.

The feed bar is transversely slotted to provide the combs 30, which define therebetween capillary cells 32. The feed bar is cut away throughout a substantial portion of its length spaced from its forward end as at 33 to provide an ink feed duct receiving slot 34. This slot opens through the rear end of the feed bar toward the ink storage compartment and also opens upwardly of the feed bar through the pen nib supporting surface thereof as shown in Figs. 1 and 8. The capillary cells 32 in the feed bar communicate with this slot.

The writing element 22 almost completely encircles the feed bar at the rear thereof as shown in Figs. 1 and 8, but terminates short of completely encircling the bar as at 35 and 37. A space is provided between the edges 35 and 37 of the writing element and between the inner surface of the pen body and the feed bar which serves as an air intake passageway 36. The rear end of the feed bar is provided with a shoulder 42 snugly received within the bore of the pen body. The shoulder is longitudinally slotted as at 41 to provide a passage therethrough which communicates with the passageway 36.

Rearwardly of the feed bar and disposed within the lower pen body is a helical air intake passage 38 of capillary dimensions formed in a reservoir section 40. The forward end of the reservoir section abuts the shoulder 42 of the feed bar, and the spiral comb or wall 44 abuts the interior or tapering bore 46 of the lower pen body, forming therewith the closed spiral or helical air intake passage 38. The passage 38 communicates at its forward end with the passage 36 through the aperture 50 in the end wall 48, and the passage 41 through the shoulder 42 of the feed bar.

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Received within the upper or rearward end of the lower pen body is the pierce-carrying insert 52. This insert abuts the shoulder 56 of the pen body thereof to position the insert in the body. The upper or rearward end of the reservoir is received within the forward or lower end of the insert as shown in Fig. 1, with the comb 44 of the reservoir abutting the inner surface 58 of the insert and forming therewith a continuation of the helical channel 38.

The helical comb 44 of the reservoir is provided at the rear end of the reservoir with a slot extending longitudinally thereof and indicated at 60. This slot provides a communicating passage between the helical groove or channel in the reservoir and the area 62 in the insert. The area 62 is formed between the rear end of the reservoir and the conical wall 63 of the insert. The area 62 opens into the passageway 65 extending back through the insert and into the pierce 68. The passageway opens into the ink storage chamber 69 through the cross apertures 66 and 64 in the pierce. The pierce 68 is a part of the insert 52 and is more particularly described in the co-pending application of Morse et al., Serial No. 408,105, filed February 4, 1954, now Patent No. 2,826,174, issued March 11, 1958.

The reservoir section 40 is provided with an axially extending generally rectangularly shaped bore 70, through which is snugly received our improved ink feeding means. This feeding means, which for convenience we have termed a sandwich feed, comprises a pair of superposed elements 72 and 74 formed of hard rubber, plastic, or the like. The elements, because formed of such materials, are limitedly flexible. They are so shaped that when inserted through the reservoir, they will be supported in the pen as shown with their meeting faces in light abutment throughout their length. The element 72 is provided with an ink feed duct 76 opening toward the meeting face of the opposite and juxtaposed element. The sandwich feed is sealed within the bore 70 of the reservoir so that neither ink nor air will pass along the sides of the sandwich feed between the sandwich feed and the reservoir section.

Co-extensive with the feed duct 76 is a pair of ink feed passages which communicate with the feed duct along the edges thereof, and throughout the length of the duct, and which feed passages are provided between the meeting faces of the elements 72 and 74. Such meeting faces, as mentioned above, lightly abut each other, with the result that if ink is exposed to them, it will be sucked rapidly between them by capillary action. Such ink feed passages are indicated in the drawings at 80 and 82. The wall-to-wall dimension of passages 80 and 82 is, as can be seen from a consideration of Figs. 2-4, substantially less than the wall-to-wall dimension of the ink feed duct 76. Both the ink feed duct and the passages 80 and 82 are of capillary dimension, that is to say, ink will capillate through the duct and the passageways from the ink storage compartment to the writing element. The capillary action of ink in the feed duct may be considered as fair capillary action, while the capillary action of ink in the passageways 80 and 82 may be considered as good capillary action. The action of ink in the passages 80 and 82 is analogous to a drop of ink placed on a pane of glass, with another pane of glass thereafter placed upon the first pane and over the drop of ink. The ink between the panes of glass, it will be observed, spreads very rapidly in all directions. This is substantially what happens in the passages 80 and 82. The ink moves in these passages from the ink storage compartment to the writing element with great rapidity. Because such passages open into and communicate with the feed duct 76, ink in the passages is in contact with ink in the feed duct.

Ink flowing through the sandwich feed from the storage compartment to the writing element enters the feed through the cross apertures 64 and 66 of the pierce, and

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through a slot 84 cut through the member 72. Ink may also enter the sandwich feed through the end of the sandwich feed as at 86. Because the passages 80 and 82 extend to the outer edges of the elements 72 and 74, ink may enter the duct 76 from the storage compartment through such passages.

As the ink enters the feed duct and the passages, it moves rapidly from the storage compartment to the writing element through the passages 80 and 82. It also moves through the feed duct toward the writing element. Because the ink in the passages 80 and 82 is in contact with the ink in the duct 76, and because there is a molecular attraction between the ink in the passages and the ink in the duct, as the ink in the passages moves toward the writing element, it tends to draw the ink in the duct along with it. The ink in the passages 80 and 82 moves toward the writing element at a greater speed than the ink in the feed duct. Consequently the molecular attraction between the molecules of the ink in the passages and in the duct tends to ensure a constant and plentiful flow of ink from the storage compartment to the writing element at all times. It also ensures an adequate supply of ink at the writing element whether the user of the pen writes very rapidly or very slowly.

That end of the sandwich feed which communicates with the writing element is provided with a slot 88 in the upper member 72, which slot opens into the capillary slit 24 in the writing element and provides a direct passage for ink from the duct 76 and passages 80 and 82 to the slit in the writing element. Capillary communication between the slot or ink passage 88, the passages, and the ink slit 24 is assured at all times by the provision of a spring member 90 which is disposed beneath the sandwich feed and within the slot 34 in the feed bar. The spring 90 tensions the sandwich feed up against the writing element as shown in Figs. 1 and 4. The ink feed connection between the sandwich feed and the writing element may be considered as a resilient connection. With such a connection between the feed duct and the writing element, capillary communication between the feed duct and the slit 24 of the nib is constantly assured.

Air may enter the storage compartment through the passage 36 and thence through the aperture 50, and following the helical groove 38 in the reservoir section, may pass into the area 62 through the slot 60, and thence outwardly of the pierce through the apertures 64 and 66, and into the compartment. Conversely, ink may flow from the compartment into the sandwich feed, or around the sandwich feed and into the area 62, through the slot 60 and thence into the helical groove 38 in the reservoir section. The function of the helical groove in the reservoir section is to prevent leaking of the pen when a flooding condition exists therein. The construction and more detailed functioning of such reservoir is set forth in our co-pending application Serial No. 496,165 filed March 23, 1955.

It will be noted from a consideration of Fig. 2 that the sandwich feed is supported in the passageway of the insert 52 at the four corners of the sandwich, and that there are four half-moon shaped passages 87, 89, 91, and 92 around the sandwich and between it and the bore of the insert. These half-moon shaped passages are of capillary dimension. Through these passages air from the helical reservoir may pass in entering the storage chamber, or ink may capillate through them in leaving the storage chamber during a flooding condition in the pen wherein the air pressure in the storage compartment exceeds the air pressure outside the pen.

As is more particularly described in the co-pending application of Morse et al., Serial No. 496,165, area 62 is of lower capillary characteristics than either the helical channel 38 or the passages 87, 89, 91, and 92, and forms an ink barrier so that ink will not freely capillate from the ink storage compartment out through the helical channel. Ink only enters helical channel 38 when the

air pressure in the ink storage compartment in the cartridge 14 exceeds the air pressure outside the pen, and the helical channel serves to accumulate the ink forced out of the storage compartment. Ink in channel 38 is held in a continuous thread by the capillary size of the channel. Ink in channel 38 is prevented from falling out by the capillary size of the channel and the fact that ink will only move in channel 38 in response to the differential in air pressures between the storage compartment and the outside of the pen. Ink forced into channel 38 returns to the storage compartment before any air enters the compartment through the channel, by the air pressure in the compartment being reduced to below the air pressure outside the pen.

One of the ways in which the air pressure in the ink storage compartment may be lowered to below the air pressure outside the pen is by writing the pen whereby ink is drawn out of the sandwich feed to the pen nib. As ink leaves the storage compartment through the sandwich feed, ink in channel 38 is drawn into the storage compartment, and any air in channel 38, behind the thread of ink, also moves toward the storage compartment. If the pen was not in a flooded condition at the time of writing, air simply enters the storage compartment by way of channel 38 to replace the ink exhausted by writing. Air therefore is returned to the storage compartment around the sandwich feed while ink leaves the storage compartment through the sandwich feed.

The four corners of the sandwich bear lightly against the interior of the bore through the insert and serve to maintain the members 72 and 74 of the sandwich in juxtaposed relation. The spring 90 at the forward end of the sandwich, while holding the sandwich up against the writing element also serves to hold the members 72 and 74 juxtaposed. The bore through the reservoir, through which snugly extends the sandwich, serves to keep the members 72 and 74 juxtaposed between its opposite ends.

In Figs. 9-12 is shown another embodiment of the invention in which the air return for the ink storage compartment is around the sandwich feed throughout the length of the sandwich. The cartridge 100 is threadedly connected to the lower pen body 102, with the pierce 104 of the pierce insert 106 extending through the puncturable disc 108, with a sealing ring 109 abutting the inner wall of the cartridge, all as shown in the co-pending application, Serial No. 408,105 hereinabove mentioned. Within the open end of the lower pen body 102 is received a feed bar 110 which is provided with encircling combs 112 which extend from substantially one end of the bar to the other. An ink feed slot 114 is cut through the combs near the rear end of the bar to permit flow of ink throughout those combs adjacent the rear end. The bar is interiorly cut away as at 116 to provide a sandwich feed receiving slot within which the forward one-half of the sandwich feed 118 is received.

The sandwich feed is of the same construction as heretofore described having an upper half 120 and a lower half 122, and is tensioned upwardly by the flat spring 124 to abut the underside of writing element 126, with the upwardly opening slot or ink passage 128 of the sandwich disposed in ink feeding communication with the slit between the nibs of the writing element. The primary ink feed channel 130 through the upper half 120 of the sandwich communicates with the juxtaposed meeting faces of the upper and lower halves 120 and 122, all as hereinafter described.

The writing element 126 overlies the feed bar and extends between the feed bar and the lower pen body as at 132. The spring is disposed at its rear end 134 between the sandwich feed and the feed bar. The sandwich feed receiving slot 116 extends above the upper edge of the sandwich as at 136 providing an air return space. The pierce insert 106 is provided with a circular bar 138

through which the sandwich extends, and within which the sandwich is supported at its four corners, as shown in Fig. 10, dividing the bar into four half-moon shaped air passageways 140, 142, 144, and 146, which open at one end into the slot 116 and space 136 above the sandwich, and open at the opposite or rear end outwardly into the ink cartridge through apertures 148 and 150 in the pierce.

In the operation of the embodiment shown in Figs. 9-12, ink flows from cartridge 100 through the sandwich feed to the writing element and air returns to the cartridge through the heart-shaped or diamond-shaped air inlet aperture 152 in the writing element, through the slot 116 and around the sandwich feed through the half-moon shaped passages to vent out of apertures 148 and 150. If a flooding condition arises, the overflow ink is absorbed by the combs in the feed bar. It is apparent that this modification differs from the one described in connection with Figs. 1-8 in that here the air return for the cartridge is around the sandwich feed throughout the length of the sandwich feed, and the means for absorbing overflow ink during a flooding condition are embodied in the combs 112 in the feed bar.

What we claim is:

1. In a fountain pen having a pen body providing an ink storage compartment, a feed bar mounted on one end of the body, a writing element supported in superposed juxtaposed relation on the feed bar and provided with a capillary slit, said feed bar provided with a slot beneath the writing element, means providing a longitudinally extending ink feed duct for conducting ink from said storage compartment to said capillary slit including a pair of juxtaposed superposed members extending therebetween, the opposed longitudinal surfaces of the said members defining an interfacial passageway of capillarity higher than said feed duct, said ink feed duct being uninterruptedly in fluid ink communication along its complete longitudinal length only with said interfacial passageway, the end portions of said members at said writing element being flexible and extending into said slot in said bar and being in an upwardly-tensioned condition, the upper surface of the uppermost member being in mating engagement with the lower surface of said writing element, said uppermost member being cut away at said writing element to define an ink passage, said ink passage being in fluid ink communication with said ink duct and said capillary slit.

2. In a fountain pen as defined in claim 1 and wherein said slot in said feed bar has a bottom wall, a flat spring positioned between the lower surface of the lower one of said members and said bottom wall, said spring having an upward bias and providing an upward tensioning force against the members.

3. In a fountain pen as defined in claim 1 and wherein said pair of juxtaposed superposed members are in face to face engagement along longitudinally extending side portions thereof to define a pair of parallel interfacial passageways of capillarity higher than said feed duct, and wherein said feed duct is defined by said members between said interfacial passageways.

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