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FOUNTAIN PEN

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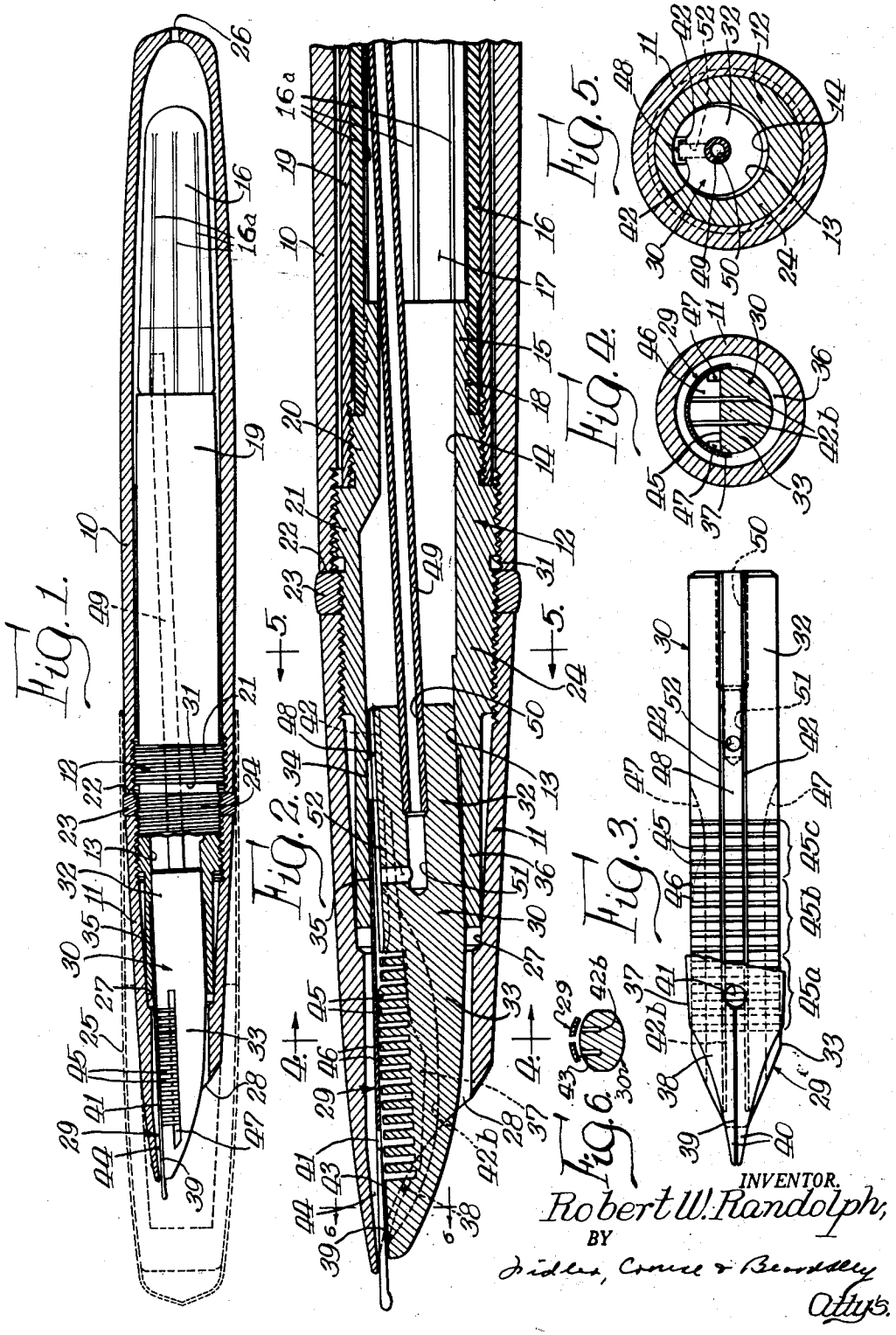

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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## FOUNTAIN PEN

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5 Claims. (Cl. 120—50)

1

This invention relates to fountain pens and has to do particularly with fountain pens of the type having ink overflow control means for preventing flooding or leaking at the writing end.

An object of the present invention is to provide an improved fountain pen of the foregoing character.

Another object is to provide a fountain pen of the foregoing character which has a relatively small number of parts and which is very simple and inexpensive to manufacture and assemble.

A further object is to provide a fountain pen of the foregoing character wherein there are relatively few critical dimensions or adjustments and the several members forming the fountain pen may be manufactured by relatively simple and inexpensive operations and may be assembled by relatively unskilled labor.

A still further object is to provide a fountain pen of the foregoing character wherein the adjustment of the parts is not extremely critical and the pen will function satisfactorily even without exact adjustment and alignment of the parts.

Another object is to provide a fountain pen of the type adapted to be filled by manual compression of a portion of the ink reservoir and having an air breather tube extending within the reservoir, which pen is of such construction that the collapsible portion of the reservoir is readily accessible and at the same time may be manipulated to fill the pen without interference with the action of the breather tube.

Still a further object is to provide a fountain pen of the type having ink overflow control means and so constructed that there is a minimum area of ink surface exposed to the atmosphere, thereby minimizing the amount of evaporation of ink from the pen.

Other objects of the invention will appear from the following description taken in connection with the appended drawings wherein:

Figure 1 is a side elevational view of a fountain pen constructed in accordance with my invention, with certain of the parts sectioned to show the interior;

Fig. 2 is an enlarged fragmentary longitudinal sectional view through the forward portion of the pen shown in Fig. 1;

Fig. 3 is a top plan view of a feed bar forming a portion of the structure shown in Fig. 1 together with a portion of the nib associated therewith;

Fig. 4 is a transverse sectional view taken along line 4—4 of Fig. 2;

2

Fig. 5 is a transverse sectional view taken along line 5—5 of Fig. 2; and

Fig. 6 is a transverse sectional view taken along line 6—6 of Fig. 2.

Referring now particularly to Fig. 1, the pen includes a casing or housing formed by a barrel 10 and a forwardly extending shell 11, which together surround and substantially enclose the internal members of the pen. A tubular body 12 which preferably takes the form of a nipple is provided for connecting the barrel and shell, as well as many of the other members forming the pen, and for retaining them in proper assembled relationship. The body member 12 is provided with a forward bore 13 and a rearward bore 14 and is formed with a plurality of different external diameters providing in effect a plurality of longitudinally adjacent sections of different diameters adapted to receive and support various pen members as hereinafter described.

At its rearward end portion the body member 12 is formed with a section 15 over which is telescoped the forward open end of a flexible and resilient sac 16, which together with the bore 14, defines an ink reservoir 17. The forward end portion of the sac 16 preferably is so formed that in its normal condition it is of slightly lesser diameter than the section 15 and thus when the sac is assembled on the latter it tightly grasps the same to retain the sac hereon. However, if desired the sac may be secured on the section 15 by a suitable adhesive such as a known cement. Retention of the sac on the section 15 preferably is rendered more positive by providing a series of circumferential external grooves 18 into which the sac material enters.

The sac 16 is formed of a suitable material of sufficient resilience to remain in expanded condition except when forcibly compressed and which is resistant to inks of the types commonly used, that is, both acid and alkaline inks and which material will not deteriorate or lose its resilience over a long period of use. Preferably the sac is formed from a material which is transparent or sufficiently translucent to permit the user to observe the level of the ink therein as hereinafter explained. While any one of a number of elastic materials may be used, excellent results have been obtained by forming the sac from a synthetic resin such as a copolymerized chloride-acetate resin commercially from Carbide and Carbon Chemicals Corp. of New York, N. Y., under the trade name of "Vinylite V," which material has been found to have the desirable characteristics as herein described. The sac 16 is

adapted to be alternately compressed manually and released to draw ink into the reservoir 17 for filling the latter in a manner which will be understood.

For the purpose of protecting the sac 16 when the latter is exposed for the filling operation, and to permit the user to hold the pen without compressing the sac accidentally thereby forcing ink from the pen, a guard 19 is provided. The guard is formed as an elongate, thin-walled, tubular member open at both ends and is telescoped over the sac and the rearward end of the body member 12. The forward end of the guard is secured to an intermediate section 20 of the body member 12, which is of slightly larger diameter than the end section 15. While the guard may be secured in any suitable manner it preferably is threaded onto the section 20 for convenience in assembly, although it may if desired be secured in other ways as by spinning the material of the guard into a groove (not shown) formed in the section 20.

The guard 19 extends rearwardly a sufficient length to permit it to be grasped readily by the user but terminates short of the rear end of the sac 16 to such a point as to permit a sufficient length of the sac 16 to project beyond the rear end of the guard 19 to allow the sac to be grasped between the fingers of the user and compressed. The guard 19 is preferably formed of thin-walled, light, but rigid material, which is of sufficient strength and rigidity to prevent the same from being bent in use but sufficiently thin and light weight so as not to consume substantial space within the pen barrel 10 or add materially to the weight of the pen.

The sac 16, or at least the portion which projects beyond the guard 19, may be formed with longitudinally extending, inwardly directed, spaced ribs 16*a* which render it more rigid.

The barrel 10 is formed with an open forward end and is adapted to be telescoped over the sac 16 and the guard 19 and a portion of the body 12 to thereby enclose the sac 16 and guard 19. The barrel is connected to the body 12 for ready detachment in order to permit convenient removal thereof to permit access to the sac for the filling operation. The barrel therefore is connected to a section 21 of the body member 12 of maximum diameter and preferably is retained thereon by screw threads. The barrel is adapted to be screwed onto the body 12 with its forward limit of movement determined by abutment against a rearwardly facing shoulder 22 provided by a clutch ring 23 threaded onto a section 24 of the body 12 of lesser diameter than the section 21. The clutch ring also may serve to retain a slip cap 25 in a manner generally similar to that disclosed and claimed in U. S. patent to Marlin S. Baker No. 2,278,907 granted April 7, 1942.

The barrel is provided with a vent opening 26 preferably located at its rear end for the purpose of equalizing the pressure between the interior and exterior of the barrel to thus prevent compression of the air within the barrel and consequent possible forcible expulsion of ink from the reservoir 17 when the barrel 10 is assembled over the sac 16 and guard 19.

The hollow shell 11 is secured on the body member 12 preferably by screwing it on the section 24. The shell 11 thus surrounds and substantially encloses the forward end of the body member 12. The shell is formed with a hollow interior providing a chamber 27 and with an opening 28 in its forward end through which a nib 29 and feed bar 30 are adapted to project as hereinafter described. The shell is screwed down against the clutch ring 23 and thus its position on the body member 12 may be predetermined by suitably positioning the ring on the body 12. If desired, the shell may be secured in position by a suitable thermoplastic cement to prevent the user from disarranging the shell but which will permit removal for repair purposes.

The feed bar 30 is formed with a shank portion 32 adapted to be slip-fitted into the forward bore 13 of the body member 12, and a body portion 33 adapted to project from the end of the body member 12. The shank 32 fits snugly in the bore 13 but the latter is relieved sufficiently as at 34 so that the rear end or shank 35 of the nib 29 may be inserted in the forward open end of the section 36 of the body member 12. The nib 29 is formed in an arcuate body portion 37 extending forwardly along the feed bar and resting upon the upper surface thereof, and is provided with a tapered writing portion 38 formed with a slit 39 providing two writing nibs 40 and terminating rearwardly in a pierce 41. The nib 29 and the projecting portion 33 of the feed bar are substantially enclosed and housed by the shell 11 except for the extreme writing tip of the nib which projects through the upper portion of the end opening 28 in the shell 11.

The feed bar is provided with means for feeding ink from the reservoir 17 to the nib slit 39, which means includes upwardly open feed slots 42 extending from the rear end of the feed bar 30 forwardly to adjacent the nib slit 39. Preferably, two slots 42 are provided, for reasons which will hereinafter appear and the two slots are disposed in spaced parallel arrangement. The tapered portion 38 of the nib closely overlies the top surface of the feed bar 30 at its forward end and a small arcuate space 43 of capillary height thereby is provided into which ink is drawn when the pen is in use. This space 43 thus insures that a body of ink is available adjacent the nib slit so that the latter remains filled so long as any ink is in the pen and the pen therefore is always in condition for instant writing.

In order to further insure against the nib slit drying out, an arcuate ink storage space 44 of capillary dimension is provided above the nib into which ink is drawn by capillary action to provide a body of ink which maintains the nib wetted on its upper surface substantially to the writing tip. The feed bar also is provided with means for admitting air to the reservoir to replace ink which is withdrawn in writing and thereby permit further ink to be withdrawn from the reservoir. The feed bar also is provided with means for receiving and storing ink which may flow from the reservoir in excess of that required for writing purposes in order to prevent flooding and leaking at the point.

A longitudinally spaced series of transversely extending ink storage spaces 45 of capillary width are provided in the upper portion of the projecting portion 33 of the feed bar which spaces 45 preferably are formed by slotting the feed bar, the slots being separated by narrow fins 46. The slots 45 are intersected by and communicate with the ink feed slots 42 and thereby are adapted to draw thereinto by capillary action ink which may tend to overflow from the ink feed slots 42 whenever conditions of excess ink flow occur in the pen. In order to insure that the column of ink extending from the reservoir to the nib slit remain unbroken so that ink will be fed to the nib

slit at all times, each of the slots 42 is provided in its forward portions with a deepened portion 42b which extends through and below the transverse slots 45.

The storage slits 45 are vented to the exterior of the pen by air vent slots 47 extending longitudinally along the sides of the feed bar and intersecting all of the transverse storage slots 45. The vent slots 47 extend through the opening 28 in the shell 11 and thus provide communication between each of the storage slots 45 and the atmosphere.

The rearmost storage slots 45 communicate with the reservoir 17 by an air duct 48 which preferably is formed as a slot in the upper surface of the feed bar shank 32 between the feed slots 42 and which opens at its rearward end into the reservoir 17 and at its forward end intersects the rearmost fins 46 and the corresponding slots 45.

As previously stated, the reservoir is filled by compressing the flexible sac 16 to draw ink into the reservoir. Preferably the pen has means for permitting a multiple stroke filling operation which provides for drawing into the reservoir a substantially greater quantity of ink than is drawn in by single compression and release of the sac 16. For this purpose a breather tube 49 is provided which at its forward end is inserted in a counterbore 50 communicating with a bore 51 which is connected by a transverse duct 52 with the air duct 48. The breather tube 49 extends a substantial distance throughout the reservoir 17 and terminates short of the rear end of the sac 16. Preferably the breather tube terminates at such distance beyond the rear end of the guard 19 that the breather tube is not collapsed or bent during the compression of the sac and thus there is no interference with the passage of air through the breather tube during the filling operation.

In order to fill the pen, the barrel 10 is removed and the writing end of the pen inserted in a supply of ink to immerse the nib slit and preferably the forward ends of the feed slots 42. The sac 16 is repeatedly compressed and released to draw ink into the reservoir. Upon each compression of the sac a quantity of air is forced out through the breather tube 49, the longitudinal passage 51 and transverse passage 52, the air passage 48, the rearmost storage slots 45 and the vent slots 47. Upon release of the pressure on the sac the latter returns to its normal expanded condition and the vacuum thus created draws ink into the reservoir 17 through the feed slots 42. It will be understood that, similarly to other multiple stroke bulb filler pens, some ink may be forced out of the pen along with the air when the sac 16 is compressed but that upon the release of the sac more ink will be drawn into the pen than was expelled with the air and thus upon repeated compression and release of the sac the quantity of ink in the pen will increase until the level of ink in the pen (when the pen is held vertically with the writing end downwardly) reaches a height substantially at the level of the rear end of the breather tube. Owing to the transparent or translucent nature of the sac 16 the operator can readily determine by inspection when the ink has reached its maximum level and is thus informed that the filling operation has been completed. As will be understood, the operator may also determine the extent of filling of the pen by the feel of the sac as the pen becomes filled, although generally it will be found easier to determine the completion of the filling operation by a visual inspection of the ink level.



When the pen is filled, a column of ink will stand in the feed slots 42 leading from the reservoir to the space 43 below the forward portion of the nib. Ink also may stand in the capillary storage cells 45 and, if desired, this ink may be cleared from the cells during the filling operation by removing the end of the pen from the supply of ink prior to the release of manual pressure on the sac at the end of the last stroke and thereafter releasing the pressure, which operation will cause the ink from the cells 45 to be drawn into the reservoir 17 leaving the cells, or at least certain of the cells, empty and in condition to receive any ink which may overflow from the feed slots 42. Ordinarily the rearmost cells 45 will remain filled with ink, which provides a liquid seal serving to close the air communication provided between the reservoir 17 and the atmosphere by the air duct 48, the storage slots 45 and the vent slots 47. However, as ink is withdrawn from the reservoir in writing a partial vacuum is created behind the body of ink in the reservoir, thus reducing the tendency of ink to flow from the reservoir. When this occurs ink will be drawn into the feed slots 42 from the rearward cells 45, thus breaking the seal provided by the ink in the slots 45 and opening air communication between the atmosphere and the air duct 48, thus permitting air to pass along the duct 48 and into the reservoir 17, whereupon ink will flow from the reservoir and along the feed slots 42 to the nib split 39.

Whenever conditions were present which would otherwise tend to cause flooding or leakage of the pen (as for example, an increase in temperature of the contents of the reservoir or a sudden decrease it atmospheric pressure), ink will overflow from the feed slots 42 into the air duct 48 and seal the air inlet passage, thereby preventing any further air from entering the reservoir. In addition, the excess ink which overflows the feed slots 42 will be drawn by capillary action into the capillary storage cells 45 and will be held there by capillary action and, therefore, will not leak from the writing end of the pen. Upon withdrawal of ink from the nib slit, as by writing, ink will be drawn first from the capillary cells 45 and thus clear the cells.

In order to insure the best operation of the overflow control means, preferably the capillary cells 45 are arranged so that the forwardmost cells are of the greatest width and of the least capillarity and the rearward cells are of the least width and the greatest capillarity, thus insuring that ink will be drawn into the feed slots 42 first from the forwardmost cells and the cells will progressively empty from the forward end of the series toward the rearward end. For convenience in manufacture the cells are not all formed of different widths but are arranged in a series wherein the cells 45a (Fig. 3) all have the same capillarity, cells 45b have the same capillarity but greater than that of the cells 45a and the cells 45c have the greatest capillarity of any of the series.

The air inlet slots 47 are formed of relatively greater width than the capillary cells 45 and are of such width as not to retain ink by capillary action under ordinary conditions. Under ordinary conditions of operation, the edge effect at the points of intersection between the cells 45 and the air vent slots 47 is sufficiently effective to prevent ink from being drawn into the latter.

It will be understood that the dimensions of the several parts of the pen may be varied widely. However, the overall dimensions of the

pen preferably are comparable to those of conventional fountain pens. It is important, however, that the relation between the several portions of the capillary system and the air vent system be maintained in order to provide the most desirable operation. The dimensions of ink feed slots **42** and the capillary cells **45** are such as to insure that ink is retained therein by capillary action under the conditions above described. In one practical embodiment of a fountain pen embodying the invention excellent results were obtained by forming the ink feed slots with a width of around 0.008''. These slots in their rearward portions were formed with a depth of at least 0.023'' and in their forward portion a depth sufficient to pass well below the capillary cells **45**. The nib slit was formed with a width around 0.001'' to 0.0015'' and the arcuate capillary space below the forward end of the nib was greater than the width of the nib slit but less than the width of the feed slots **42**. The capillary cells **45***a* were formed with a width of 0.014'', the slots **45***b* with a width of 0.012'' and the capillary slots **45***c* with a width of 0.010''. The side slots **47** were formed with a height of around 0.031'' and an approximately equal depth. The air passage **48** was approximately 0.060'' in width and 0.008'' in depth at the sides adjacent the slots **42** and approximately 0.012'' at the center.

From the foregoing it will be seen that the present invention provides a fountain pen having ink overflow control means, which pen is simple and inexpensive to manufacture and rugged in construction. The pen is formed of a relatively small number of parts which may be easily formed by quantity production methods and may be readily assembled by relatively unskilled labor. The construction of the pen is such that there are relatively few critical dimensions and the parts do not require any extremely critical adjustment. In fact the pen will operate satisfactorily even though the parts may become somewhat disarranged after assembly. It is important, of course, that the positioning of the nib relative to the feed bar be preserved with sufficient accuracy to insure that ink would be fed to the nib slit but it is to be noted that even some disarrangement will not prevent this operation.

The ink feed slots provide a direct connection between the ink reservoir and the space under the nib slit and since they are formed in a single unitary member, namely, the feed bar there is little possibility of interruption to the feed of ink from the reservoir to the nib slit. Moreover, since a plurality of slots are provided, the clogging of one slot would not prevent feed of ink to the nib slit. Moreover, since a plurality of capillary cells at the rearward end of the series are interposed in the air inlet passage, the clogging of one of the cells would not prevent the admission of air to the reservoir upon the exhaustion of ink from other of these cells. On the other hand, the control of ink flow from the reservoir to the nib slit is positively controlled and promptly upon existence of excess ink flow conditions the admission of air into the reservoir is halted by the filling of the rearmost cells.

The nib and feed bar are substantially surrounded and enclosed by the shell, thereby preventing soiling of the fingers of the user. Moreover, the capillary ink feed slots as well as the storage or overflow spaces are substantially enclosed by the nib so that a minimum ink surface is exposed to the air. It will be noted that the side slots communicate with the exterior of the pen only at their forward ends.

The filling mechanism is simple but positive and is not readily subject to disarrangement or malfunctioning but will operate for a long period of use without adjustment or repair. Both the filling arrangement and the ink flow control means are of such form and construction that they do not occupy a substantial portion of the space within the pen barrel and shell and thus a relatively large capacity reservoir may be provided in a pen of any predetermined overall dimensions.

I claim:

1. A fountain pen comprising a hollow body member having an ink reservoir space therein and an open forward end, a feed bar mounted in the open forward end of said body member and projecting therefrom, and a slitted writing nib overlying the projecting portion of said feed bar, said feed bar being formed with a capillary ink feed passage extending continuously therealong for connecting the ink reservoir space in ink feeding communication with the nib slit, a longitudinally spaced series of capillary ink storage slots extending transversely of the projecting portion of said feed bar the rearmost of which are narrower and of greater capillarity than the slots forwardly thereof, in communication with said ink feed passage and underlying and substantially inclosed by said nib, said feed bar, body and nib defining an air inlet passage extending along said ink feed passage from said reservoir space to the rearmost slots only of said storage slots and terminating rearwardly short of the nib slit, said air passage being in communication throughout its length with said ink feed slot, and an air inlet slot extending along said feed bar, in intersection with said storage slots and communicating with said air inlet passage for air flow therebetween solely through said rearmost storage slots and having its forward end communicating with the atmosphere.

2. A fountain pen comprising a hollow body member having an ink reservoir space therein and an open forward end, a feed bar mounted in the open forward end of said body member and projecting therefrom, and a slitted writing nib overlying the projecting portion of said feed bar, said feed bar being formed with a capillary ink feed passage extending continuously longitudinally thereof and connecting said ink reservoir space in ink feeding communication with the slit of said nib, a longitudinally spaced series of transversely extending capillary ink storage slots intersected by the forward portion of said ink feed passage, the rearmost of which slots are narrower and of greater capillarity than the slots forwardly thereof, an externally disposed first air inlet duct extending along and communicating throughout its length with the rearward portion of said ink feed passage and intersecting the rearward storage slots only, a longitudinally extending air breather duct extending internally of said feed bar, communicating at one end with said first, external air inlet duct rearwardly of said ink storage slots, said first air inlet duct being inclosed by said body member and nib and having air flow communication with the atmosphere solely through said rearward slots, and an externally disposed air inlet duct extending along said feed bar, intersecting said storage slots, and communicating with the exterior of said shell.

3. A fountain pen comprising a hollow body

member having an ink reservoir space therein and an open forward end, a feed bar mounted in the open forward end of said body member and projecting therefrom, a slitted writing nib overlying the projecting portion of said feed bar, a hollow shell mounted on the forward end of said body member and substantially enclosing the projecting portion of said feed bar and said nib except the writing tip thereof, said feed bar being formed with a pair of spaced, capillary ink feed slots extending continuously longitudinally therealong from the rear end of said feed bar to short of the forward end thereof, a longitudinally spaced series of transversely extending capillary ink storage slots intersecting said ink feed slots at their forward portions, said feed bar, body and nib defining a first air inlet duct extending along the rearward portions of said feed slots, connected at its forward end to the rearmost storage slots only of said series and communicating throughout its length with said feed slots, said feed bar having an internal air breather passage extending from the rear end of said feed bar and communicating with said first air inlet duct intermediate its ends and rearwardly of said ink storage slots, and a breather tube communicating at its forward end with said internal air breather passage and extending rearwardly in said body member, said feed bar having a second air inlet duct communicating at its forward end with the exterior of said shell and intersecting said ink storage slots.

4. A feed bar for a fountain pen comprising a body having a capillary ink feed slot in its upper surface extending longitudinally from the rear end of said body continuously to short of the forward end thereof, a series of longitudinally spaced capillary ink storage slots extending transversely through the upper portion of said body and intersecting said feed slot, the rearwardmost slots of said series being of less width and greater capillarity than the remaining slots of the series, a first air inlet slot extending longitudinally along the side of said body from the forward end to short of the rear end thereof and intersecting said storage slots, and a second air inlet slot extending longitudinally along the upper surface of said body in communication throughout its length with said ink feed slot, said second air inlet slot terminating short of the forward end of said series of storage slots and intersecting the rearward slots only of said series.

5. A feed bar for a fountain pen and adapted to be associated with an overlying nib, said feed bar comprising a generally cylindrical body having a pair of capillary ink feed slots in its upper surface extending continuously longitudinally from the rear end of said body to short of the forward end thereof, a series of longitudinally spaced capillary ink storage slots extending transversely through the upper portion of said body and intersecting said feed slots, the rearmost of said ink storage slots being narrower and of greater capillarity than the ink feed slots forwardly thereof, a first air inlet slot extending longitudinally along the side of said body from the forward end to short the rear end thereof and intersecting said storage slots to provide an air inlet passage when the feed bar is assembled with the nib in a pen, said body having a depressed, generally flat surface extending longitudinally along the upper surface of said body from the rear end thereof, between said ink feed slots and terminating short of the forward end of said series of storage slots adjacent the rearward slots only of said series to provide a second air inlet passage when the feed bar is assembled with the nib in a pen, an air breather duct extending interiorly of said body from the rear end thereof to short of the forward portion of said second air inlet slot and a transverse air duct connected to said air breather duct and opening into said generally flat surface rearwardly of said ink storage slots and solely between said ink feed slots.

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