Dec. 9, 1952 J. A. MUSTARD 2,620,774

FOUNTAIN PEN

Filed June 8, 1948 3 Sheets-Sheet 1

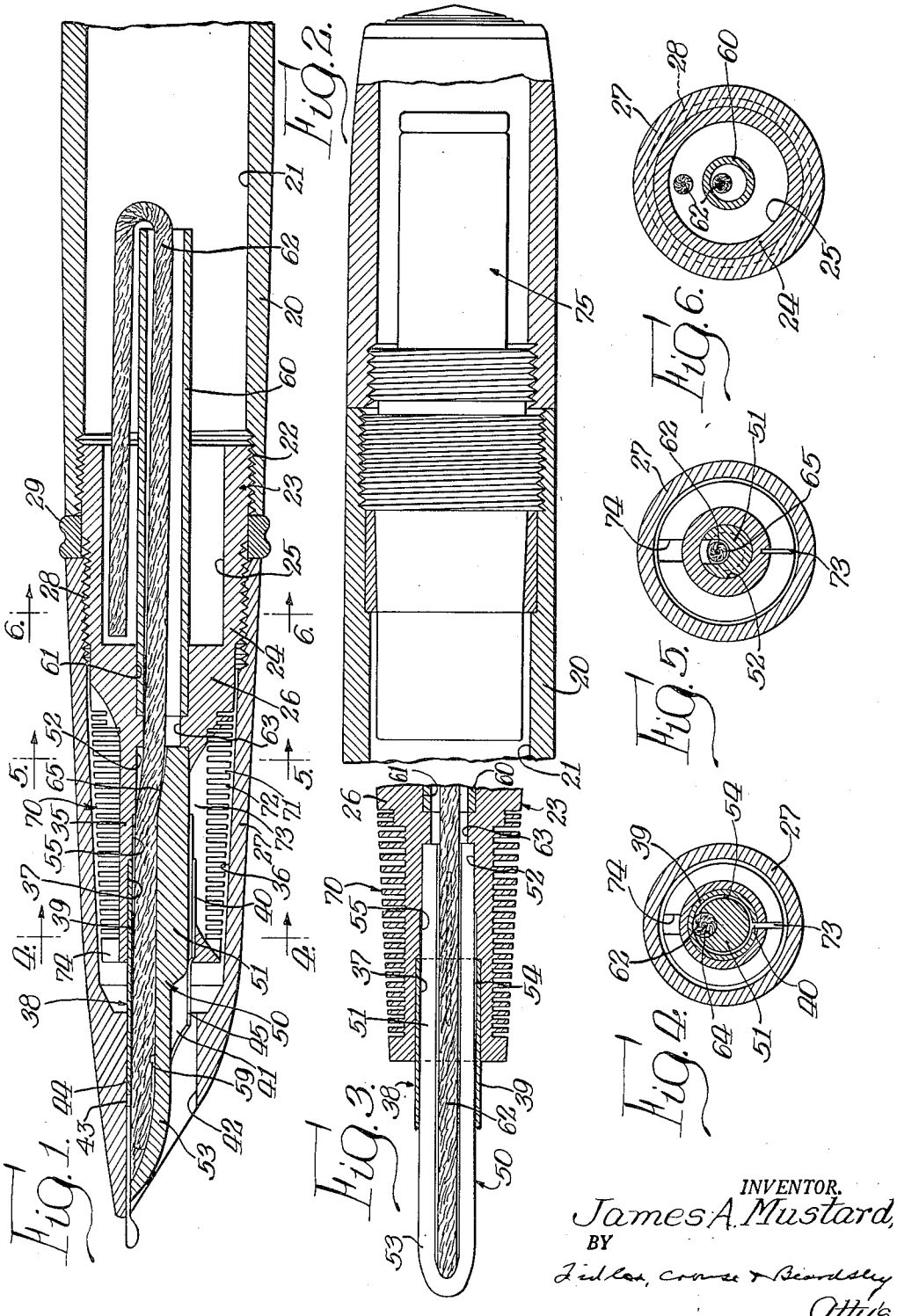


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

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FOUNTAIN PEN

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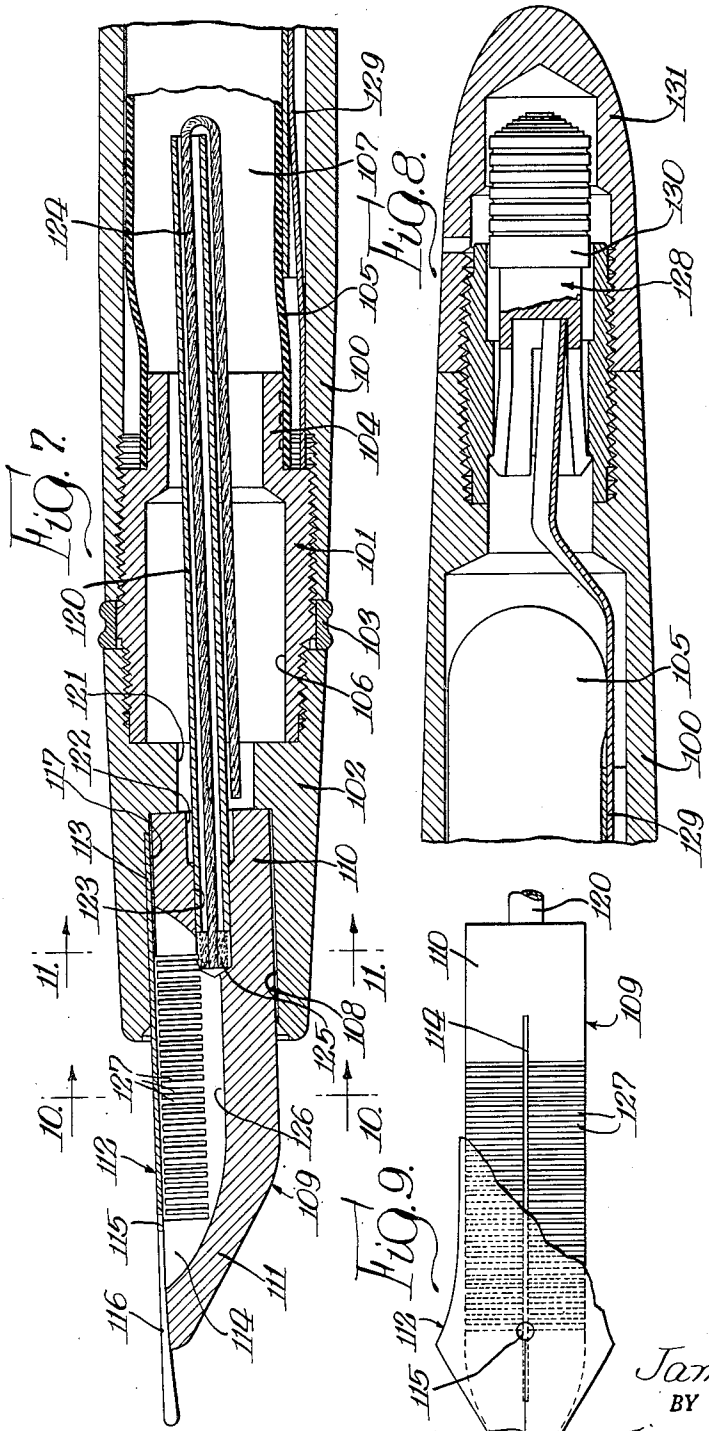


Fig. 7.

Fig. 8.

Fig. 9.

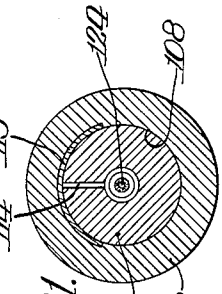


Fig. 11.

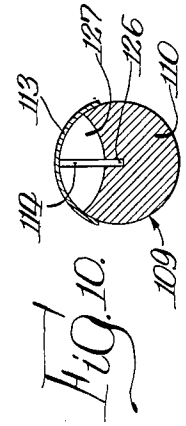


Fig. 10.

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FOUNTAIN PEN

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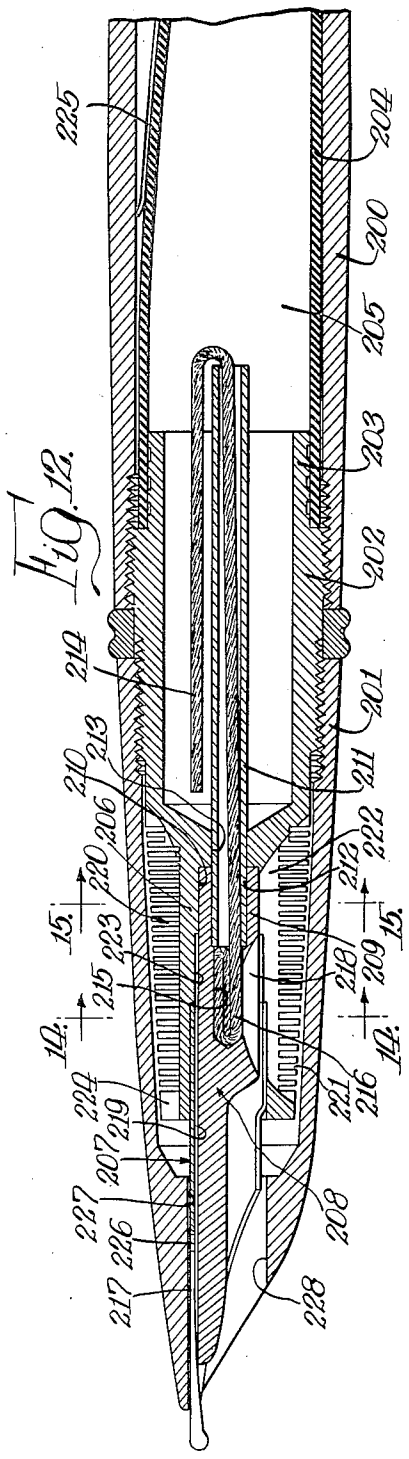


FIG. 12.

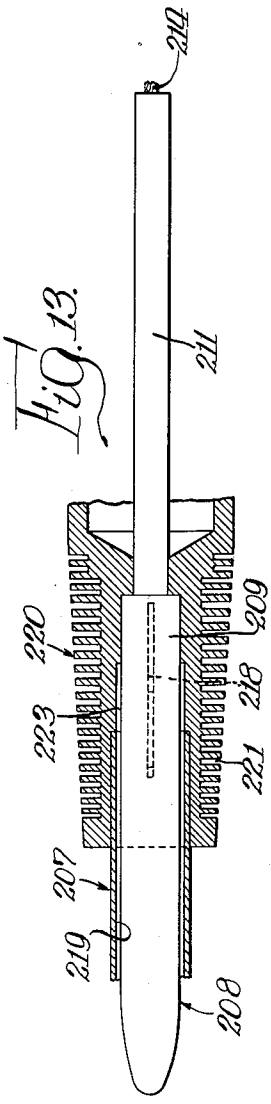


FIG. 13.

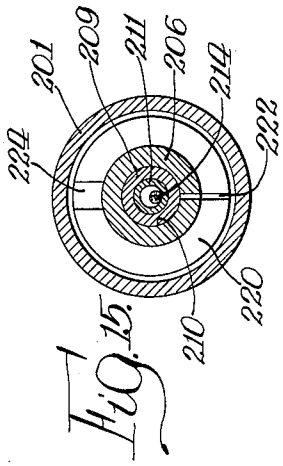


FIG. 15.

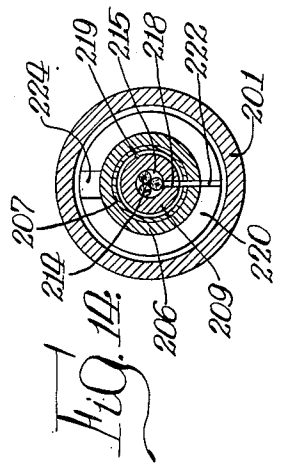


FIG. 12.

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2,620,774

FOUNTAIN PEN

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Application June 8, 1948, Serial No. 31,763

3 Claims. (Cl. 120—50)

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My invention relates to fountain pens and has to do particularly with an improved feed for feeding ink from the ink reservoir to the writing element.

An object of the present invention is to provide a fountain pen having a new and improved feed.

Another object is to provide a fountain pen wherein the feed of ink from the reservoir to the writing element does not depend for its operation upon the establishment and maintenance of any pressure balance between the air in the interior of the reservoir and the atmosphere.

Another object is to provide a fountain pen wherein the outlet leading from the interior of the ink reservoir is above the level of the ink in all positions of the pen whereby the pen is not subject to leakage, thus permitting the reservoir to be vented and thereby prevent leakage of the pen even when rapid changes in atmospheric pressure take place.

Another object is to provide a fountain pen wherein the ink feeds uniformly when the pen is in use, regardless of any changes in the temperature or pressure of the contents of the pen or the atmosphere surrounding the pen.

A further object is to provide a fountain pen which may be carried in any position and which is not subject to leakage, even at relatively high altitudes.

A further object is to provide a fountain pen having a highly effective and reliable feed which is not subject to flooding or starving.

A further object is to provide a fountain pen which is simple in construction, reliable in operation, and which may be made economically.

Still another object is to provide a fountain pen having relatively few or no critical dimensions or adjustments and which can be assembled and serviced by relatively inexperienced persons.

A further object is to provide a fountain pen which effectively maintains ink at the writing point for instant writing even when the writing point has been left exposed for relatively long periods of non-use.

A further object is to provide a fountain pen in which the necessity for close control of the flow of air into the pen reservoir is eliminated, the ink being under capillary control and the reservoir being fully vented at all times.

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

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Figure 1 is an enlarged fragmentary, longitudinal, sectional view taken through the forward portion of a fountain pen constructed in accordance with this invention;

Fig. 2 is a view similar to Fig. 1, showing the rear portion of the fountain pen;

Fig. 3 is a fragmentary view of the forward portion of the feed of the pen shown in Fig. 1, certain of the parts being horizontally sectioned;

Fig. 4 is a transverse, sectional view taken along line 4—4 of Fig. 1;

Fig. 5 is a transverse, sectional view taken along line 5—5 of Fig. 1;

Fig. 6 is a transverse, sectional view taken along line 6—6 of Fig. 1;

Fig. 7 is an enlarged fragmentary, longitudinal, sectional view taken through the forward portion of another embodiment of my invention;

Fig. 8 is a similar view taken through the rearward portion of the pen in Fig. 7;

Fig. 9 is a fragmentary top plane view of the feed bar and a portion of the breather tube;

Fig. 10 is a transverse sectional view taken along line 10—10 of Fig. 7;

Fig. 11 is a transverse sectional view taken along line 11—11 of Fig. 7;

Fig. 12 is an enlarged longitudinal, sectional view taken through the forward portion of a further embodiment of my invention;

Fig. 13 is a fragmentary view of a portion of the feed of the pen in Fig. 12, certain of the parts being horizontally sectioned;

Fig. 14 is a transverse sectional view taken along line 14—14 of Fig. 12; and

Fig. 15 is a transverse sectional view taken along line 15—15 of Fig. 12.

The present invention may be embodied in fountain pens of a number of different types and having various types of ink reservoirs, filling devices, writing elements and support means therefor, and the like. For the purpose of illustrating the invention, several different embodiments of my invention are disclosed herein, but it will be understood that the invention is not limited thereto.

Referring particularly to Fig. 1, the pen comprises a barrel 20 having an itnerior chamber defining an ink reservoir 21. Secured in the forward open end of the barrel 20 as by screw threads 22 is a plug or body 23 having a generally cylindrical coupling portion 24 defining a chamber 25 which serves as an extension of the ink reservoir, and an end wall 26 which closes the forward end of the reservoir. A shell

27 is secured as by threads 28 on the body 23 and constitutes a forward extension of the barrel 20, serving to enclose the feed and a portion of the writing element hereinafter described; the barrel 20 and shell 27 together form the pen body or housing. A clutch ring 29 may be mounted on the plug 23 for frictionally receiving a slip-fitting cap in a known manner.

A writing element is carried at the forward end of the pen housing and is connected in ink feeding relation to the reservoir to receive ink therefrom in a manner hereinafter more fully described. While the writing element shown and described herein may take the form of a slitted nib of more or less conventional construction, it will be understood that the invention is not thus limited and that any suitable type of writing element may be employed.

Carried by and preferably integral with the plug 23 is a core 35 which extends substantially throughout the space 36 within the shell 27. The core 35 has a bore 37 adapted to frictionally receive and mount a pen nib 38 of any suitable form, as for example one having a generally cylindrical body portion 39 which is slitted as at 40 and is resiliently held in the bore 37. The nib 38 is formed with a tapered writing portion 41 which extends through an opening 42 in the forward end of the shell 27 and which is provided with the usual pierce 43 and slit 44 extending therefrom through the writing tip. The nib also is formed on its underside with an air vent notch 45 for a purpose which will hereinafter appear.

A feed bar 50 is provided which has a generally cylindrical body portion 51 seated in a bore 52 in the plug 23, which extends rearwardly of the bore 37. The feed bar extends through the nib 38 and has a reduced forward portion 53 adapted to bear against the forward end of the nib and which is spaced sufficiently from the bottom wall of the bore 42 to permit air to pass into the interior of the shell 27. The body 51 of the feed bar is of slightly smaller diameter than the body portion of the nib, thereby providing an annular space 54 therebetween for a purpose which will hereinafter appear. A bore which is of slightly greater diameter than the feed bar and approximately equal to the interior diameter of the nib provides an annular space 55 surrounding the feed bar rearwardly of the nib 38 and which communicates with the annular space 54 between the nib and feed bar.

For the purpose of feeding ink from the reservoir 21 to the nib slit 44 and pierce 43, there is provided feed means which draws ink from the reservoir solely by capillary action and delivers it to the nib. The communication between the interior of the reservoir and the exterior of the pen is so arranged that no ink can pass freely from the reservoir in any position of the pen except that which is drawn from the reservoir by the capillary feed means and solely under capillary control, thereby insuring against leakage of ink from the reservoir under the influence of gravity or an unbalance of pressures between the interior of the reservoir and the exterior of the pen. The reservoir is continuously vented to atmosphere and the outlet from the reservoir is so positioned that it is always above the maximum level of the ink in the reservoir, thereby preventing ink from either flowing out of or being forced out of the reservoir upon the establishment of an increased pressure in the reservoir.

To the foregoing end, a tube 60 is seated in a bore 61 in the end wall 26 and extends rearwardly into the reservoir 21 a substantial distance. The tube 60 is of such length that its inner end is disposed above the level of the ink in the reservoir and is open to the air in the resrvoir in all positions of the pen and no ink can flow from the reservoir directly into the tube 60 by reason of the effect of gravity when the pen is in point-down position; neither can any ink be forced into the tube 60 by an increase in pressure in the air in the reservoir such as might occur when the pen is carried to a high altitude or the contents of the reservoir are heated. The inner end of the tube 60 is located at the volumetric mid-point of the reservoir space so that it is above the ink level in any position of the pen.

For the purpose of feeding ink by capillary action from the reservoir to the nib slit 43, a wick 62 is provided which extends from the forward end of the reservoir 21 and through the tube 60 and a bore 63 communicating with the inner end of the tube 60 and thence through an arcuate slot or groove 64 formed in the upper side of the feed bar 50 from the rear end thereof to just short of the forward end. The forward portion of the wick 62 is maintained in contact with the under side of the nib and in ink feeding relation to the nib slit 44 and pierce 43. The notch 64 may be slightly undercut as indicated at 65 in order to permit the wick to pass readily from the bore 63 into the notch 64 and to provide an air space therearound.

The wick may be made in any suitable manner which will provide the desired capillary characteristics. The wick is formed of material which preferably is inert to inks of the types with which the pen is to be used and which is suitably wettable by such inks. While various materials may be used, I have found that nylon fibers or spun glass fibers have properties which make them highly desirable for use in my novel fountain pen. Preferably, the nylon or spun glass fibers are supported by a member, such as a wire or wires, having sufficient rigidity to maintain the desired positioning of the wick, particularly that portion of the wick which extends in the ink reservoir. It is particularly desirable that the inner end of the wick shall extend to and be maintained in position in the forward end of the reservoir so that it will be submerged in the ink within the reservoir when the pen is in writing position even though only a small quantity of ink may remain in the reservoir; thus, it is possible to write out the reservoir substantially completely.

It will now be seen that when the reservoir contains ink and the pen is held in writing position, the lower or forward end of the wick will be immersed in the ink and, owing to the capillary action exerted on the ink by the wick, ink will be drawn into the wick and will be raised along the portion of the wick which extends into the reservoir. Ink will be drawn from the aforementioned portion of the wick to completely saturate the wick so that a continuous body or column of ink extends from the free body of ink within the reservoir to the nib slit. Ink is drawn by capillary action from the wick 62 and into the nib slit 44 so that ink stands at all times in the nib slit and the pen is always in condition for instant writing. The wick preferably is made circular in form but preferably does not completely fill the several spaces in which it is located, such as the spaces between the feed bar and the nib, and between the feed bar and core, the bore 63 and the tube 60. Therefore, an inlet channel is provided so that air to replace ink which is

withdrawn from the reservoir may be admitted through the opening 42 in the front end of the shell and pass into the annular space 54 between the nib and feed bar and thence through the slot 64, the bore 63 and the tube 60.

In order to prevent leakage of the pen should the wick be fully saturated and a sudden increase in pressure or temperature within the pen occur which might tend to force ink from the wick, an overflow collector 70 is provided which preferably is disposed in the space 36 in the shell and is formed integrally with the plug 23. The overflow collector may take any suitable form but preferably it comprises a plurality of longitudinally-spaced capillary cells or spaces 71 which extend circumferentially around the core 35. The spaces 71 preferably are formed by cutting slots in the member forming the collector, leaving spaced, relatively thin circumferential fins 72 which serve to define the slots 71. The slots 71 are intersected by a slot 73 extending longitudinally of the collector and extending radially inwardly through the collector to intersect the annular spaces 54 and 55, thereby providing communication between the cells 71 and the aforesaid circumferential spaces which latter are of capillary width and are therefore in capillary ink feeding communication with the wick 62. Thus, should flooding or overflow conditions occur in the wick, any ink which tends to leak therefrom is drawn into the capillary spaces 54 and 55 and into the slit 73 and thence into the capillary cells 71. In order to permit the cells 71 to fill and empty readily, a breather slot 74 is provided which extends longitudinally of the collector, preferably diametrically opposite to slot 73 and which intersects all of the cells 71. The breather slot 74 is of sufficient width so that ink is not drawn therein by capillary action but, due to the edge effect at the intersections of the cells 71 with the slot 74, is retained in the cells, thereby leaving the breather slot 74 unobstructed by ink and permitting a free communication between each of the cells and the atmosphere by way of the breather slot 74.

Any suitable type of filling mechanism may be provided for filling the ink reservoir to the desired extent. For example, a filling mechanism of the multiple stroke plunger type generally similar to that disclosed in U. S. Letters Patent to Arthur O. Dahlberg, Patent No. 1,904,358, granted April 18, 1933, may be provided. The tube 60 serves not only for the purpose hereinbefore described, but also as the breather tube through which ink is drawn in during the suction stroke and air is expelled during the compression stroke of the filling mechanism.

The present invention may be incorporated in fountain pens of many different types and, for the purpose of further illustrating the invention, it is shown in Figs. 7 to 11 as incorporated in a pen of the exposed nib type wherein the nib and feed bar associated therewith are mounted in and project from the forward end of a pen section.

Referring now particularly to Fig. 7, the pen includes a barrel 100 having threaded into its open end a plug or nipple 101 which serves as means for attaching a pen section 102 to the barrel. A clutch ring 103 may be provided, if desired. The plug 101 is formed with a rearwardly extending reduced extension 104 over which is secured the open forward end of a flexible sac 105 which sac, together with the interior 106 of the plug 101, defines an ink-containing reservoir space 107. The sac 105 may be of any suitable material and is secured to the extension 104, preferably by an adhesive.

Secured in the bore 108 in the forward end of the pen section 102 is a feed bar 109 having a body portion 110 sitting snugly in the bore 106 and a tapered forward end portion 111. A nib 112 of conventional form and having an arcuate body portion 113 with a tapered forward end 114 provided with a pierce 115 and a slit 116 extending therefrom to the writing tip of the nib is frictionally wedged in the bore 106, the upper portion thereof being relieved as at 117 to admit the nib.

Means are provided for feeding ink from the reservoir to the nib slit 116 operating upon a generally similar principle to the feed means shown in Figs. 1 to 6 and described hereinbefore. Extending into the reservoir 107 is a tube 120 which extends through a bore 121 in the pen section 102 and a bore 122 in the feed bar 109 and is seated in a reduced bore 123 but terminates rearwardly short of the forward end of the latter, as will be seen in Fig. 7. A wick 124 having its one end in the forward end of the reservoir 107 and preferably in the well formed by the bore 121, extends through the tube 120 and has its forward end 125 extending out of the forward end of the tube 120 and into the bore 123 forwardly of the tube 120. Ink feeding communication between the forward end of the wick 124 and the nib slit 116 is provided by a longitudinally-extending slot 126 of capillary width cut into the feed bar 109 so as to intersect the bore 123 and to be in alignment under the nib slit 116.

For the purpose of providing for overflow conditions and to prevent leakage of the pen when such conditions occur, a plurality of capillary cells 127 are provided which are formed by transversely-extending capillary slits arranged in a spaced series longitudinally of the feed bar 109 and intersected by the feed slot 126. Thus, should any ink be forced out of the feed wick hereinafter described and tend to flood the feed slot 126, such ink will be drawn by capillary action into the capillary cells 126.

Any suitable type of filling mechanism may be provided for filling the reservoir and there is shown by way of example a well-known type of mechanism of single-stroke type filling mechanism 128 employing a pressure bar 129 actuated by a plunger 130 which may be enclosed in a detachable blind cap 131.

The pen is filled by actuating the filling mechanism in a known manner to compress the sac 105 forcing air therefrom through the tube 120, the feed slit 126 and the nib pierce 115 and slit 116, and also through the slots 127 at the forward portion of the feed bar where the nib does not close these slots. When the plunger of the filling mechanism is released, the sac 105 expands to its original position and the suction thus created draws ink into the pen along the path just described but in a reverse direction to that taken by the air during the compression of the sac. The rear end of the tube 120 is located so that it is above the maximum filling level of ink in the reservoir 107 and thus no ink can flow freely into the tube 120. However, when the pen is held in writing position, the ink which is in the reservoir stands at the forward end, and the forward end of the wick is immersed therein and draws ink thereinto to saturate the wick. The forward end of the wick being in ink feeding relation with the feed slot

126, ink is drawn into the latter and delivered thereby to the nib slit 116. It will be noted in this connection that the slot 126 passes under the lowermost portions of the collector slots 127 and thus a continuous capillary path is provided from the forward end of the wick 124 to the nib slit 116. Air to replace ink which is withdrawn in writing enters the pen through the pierce 115 (and through the forward cells 127 when they are free of ink) and passes along the feed slot 126, particularly along the upper portion thereof, and enters the tube 120 through which it passes to the interior of the reservoir 107.

A further embodiment of my invention is illustrated in Figs. 12 to 15 which embodiment is somewhat similar to the form shown in Figs. 1 to 6 and therefore will be described only in respect to those features in which it differs therefrom, it being understood that where the structure of the embodiment of Figs. 12 to 15 is not described in detail, it is similar to the structure of the first described embodiment.

Referring now particularly to Fig. 12, the pen comprises a barrel 200 having a shell 201 connected thereto by a plug 202. The plug 202 is generally similar to the plug 23 above described but has a rear extension 203 for attachment of a sac 204 which, together with the interior of the plug 202, forms an ink reservoir 205. It should be pointed out at this point that in any of the several forms of the invention illustrated herein, the reservoir may be defined either by the barrel itself as illustrated in Fig. 1 or by a sac as illustrated in Figs. 7 and 12, an appropriate type of filling mechanism being provided in each case.

In the embodiment of the invention, illustrated in Fig. 12, a core 206 extends forwardly in the shell 201 and carries a slitted nib 207 and a feed bar 208, the latter having a generally cylindrical body portion 209 secured in a bore 210 in the core 206. A breather tube 211 is seated in a bore 212 in the rear end of the feed bar and extends through a bore 213 in the forward wall of the plug 202 and into the reservoir 205. A wick 214 extends through the breather tube 211 and into a recess 215 in the body of the feed bar 208 forwardly of the forward end of the breather tube 211. The forward end 216 of the wick 214 preferably is folded upon itself several times to insure that it is retained snugly in the recess 215.

The forward end of the wick 214 is connected in ink feeding communication with the slit 217 of the nib by a slot 218 formed in the feed bar 208 preferably in the under side thereof and by an annular capillary space 219 defined between the nib and feed bar by reason of the fact that the body of the feed bar is of slightly lesser diameter than the internal diameter of the nib.

If desired, an overflow ink collector 220, generally similar to the collector 70 described above, may be provided which includes a plurality of longitudinally-spaced, circumferentially-extending capillary cells 221 connected by a longitudinally-extending slot 222 to an annular space 223 defined between the body 209 of the feed bar and the surrounding porion of the core 206 rearwardly of the rear end of the pen nib 207. An air breather slot 224 may be provided in the top portion of the collector 220 in a manner similar to that above described.

A suitable filling mechanism, of which only the pressure bar 225 is shown, may be provided, as above explained.

The pen is filled in the usual manner and when the filling mechanism is operated, ink is drawn in through the nib slit 217 and pierce 226 and thence into the annular space 219 and through the slot 218 into the breather tube 211 and thence into the reservoir 205. Ink is delivered from the reservoir to the nib slit by capillary action, the ink being drawn into the wick 214 and thence into the slot 218 and into the annular space 219 from whence it is drawn by capillary action into the nib slit 217. If desired, a slight clearance as indicated at 227 may be provided above the nib, which clearance is of capillary dimension and therefore will draw ink from the nib pierce and will retain ink by capillary action above the nib so that the nib slit is always wetted and ink to replace that which evaporates from the nib slit is always available to prevent drying out of the exposed portion of the nib. Air to replace ink which is withdrawn from the reservoir in writing enters the pen through the forward bore 226 and passes through the annular space 219 and the slot 218 and thence into the breather tube 211.

From the foregoing, it will be seen that the present invention provides a fountain pen in which the ink reservoir is constantly vented to atmosphere and accordingly, the operation of the pen is entirely independent of any changes which may take place in the atmospheric pressure or in the temperature of the contents of the pen. Therefore, the pen is not subject to leaking even when carried to high altitudes or when the pen is warmed as by the heat of the hand.

The feed of ink from the reservoir to the nib is effected entirely by capillary action and therefore is independent of any changes of temperature or pressure of the surrounding atmosphere or of the contents of the reservoir. Accordingly, the pen feeds with a uniform and controlled flow of ink and is not subject to flooding or starving. Since the ink is delivered to the nib slit by capillary action and no pressure balance between the interior of the reservoir and the exterior atmosphere is required, either for retaining the ink in the reservoir or allowing it to feed to the nib, ink is maintained at all times at the nib and the pen is always in condition for instant writing. Should any evaporation of ink take place at the nib, the ink which evaporates is promptly and constantly replaced so that the nib is always maintained in wetted condition. The outlet from the ink reservoir may be and preferably is disposed above the maximum filling level of the ink in the reservoir and therefore ink will not flow from the reservoir except as drawn therefrom by the capillary feed means. Consequently, the pen may be carried in any position without leaking. The overflow collector provides insurance against even the slight leakage which might possibly occur in the event that a sudden change in temperature or pressure occurs of such nature that it tends to force a small amount of ink from the saturated capillary feed member.

The present invention, furthermore, provides a pen consisting of a relatively small number of simple parts which may be assembled readily and without requiring critical adjustments. In fact, the pen will operate satisfactorily even though the parts may not be accurately assembled or may become disarranged somewhat during use.

I claim:

1. A fountain pen comprising a pen body having a reservoir therein, an air vent passage leading from said reservoir substantially at the volumetric mid-point thereof for constantly and freely maintaining the contents of said reservoir substantially

at atmospheric pressure and constituting the sole outlet from said reservoir, a filling mechanism for drawing ink into said reservoir solely through said passage, a writing element, and a form-sustaining capillary ink feed element having a portion in said reservoir and extending into the forward portion of said reservoir and of sufficient rigidity to maintain its said portion in said forward portion of the reservoir and a portion extending through and incompletely filling said vent passage and connected in ink feeding relation to said writing element for feeding ink from the reservoir by capillary action to the writing element.

2. The invention as set forth in claim 1, wherein the pen body includes a barrel open at its forward end and wherein is provided plug means closing the open end of said barrel, a feed bar carried by said plug means and having a feed passage underlying said writing element, and wherein said capillary feed element comprises a single wick extending continuously from said reservoir and into the feed passage in said feed bar.

3. The invention as set forth in claim 1, wherein the pen body includes a barrel open at its forward end and wherein is provided plug means closing the open end of said barrel and carrying

said writing element and over-flow collector means, including capillary cells, connected in ink-receiving relation to said feed element for receiving and storing ink which passes out of said reservoir in excess of the capacity of said feed element.

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