Sept. 9, 1941. G. E. ZIEGLER 2,255,093

FOUNTAIN PEN

Filed July 1, 1940

Fig. 1

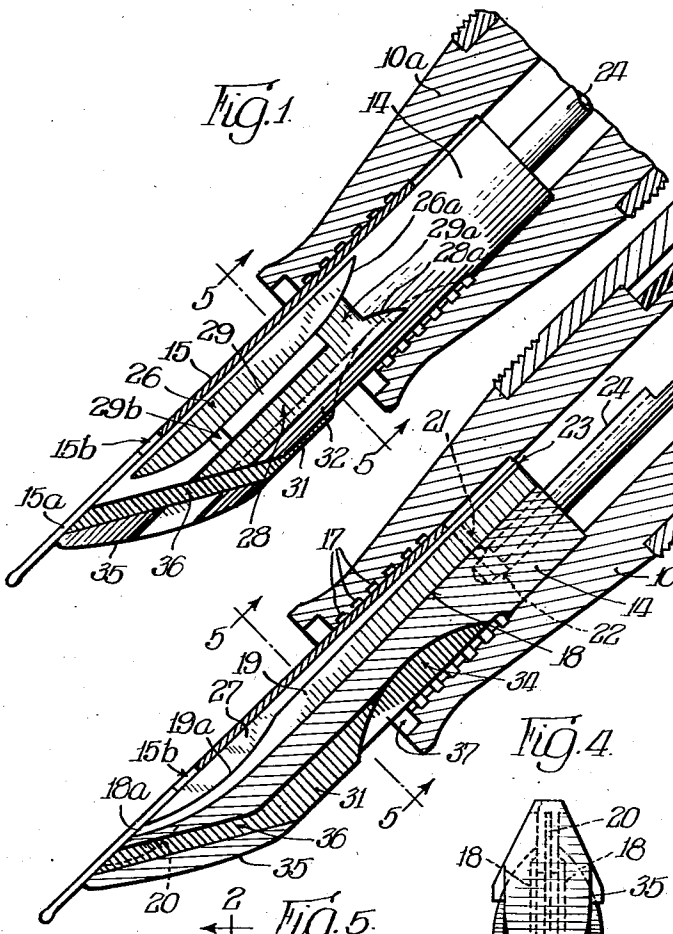


Fig. 2

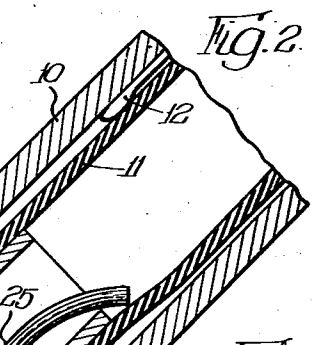


Fig. 3

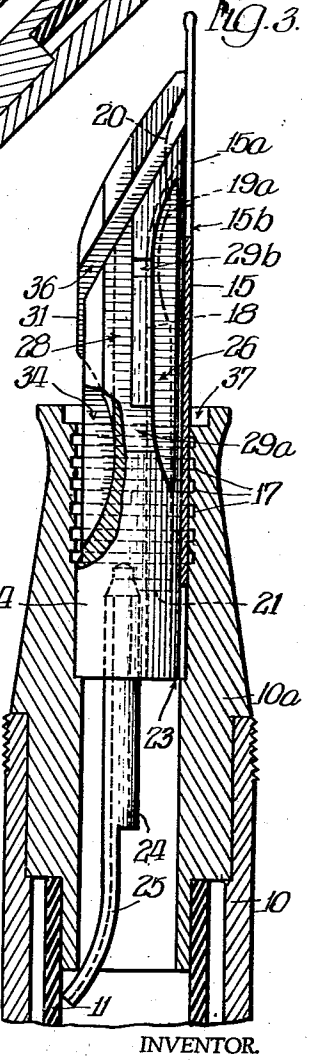


Fig. 4

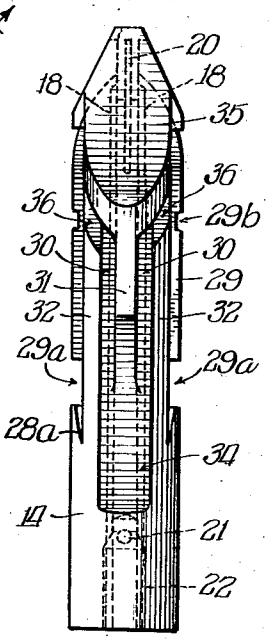
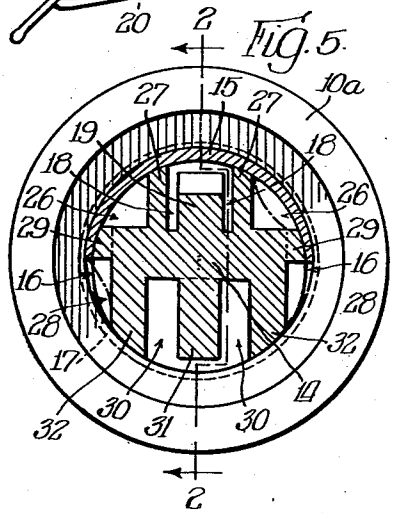


Fig. 5



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UNITED STATES PATENT OFFICE

2,255,093

FOUNTAIN PEN

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Application July 1, 1940, Serial No. 343,356

21 Claims. (Cl. 120—50)

This invention relates to fountain pens and pertains particularly to improvements in ink feeding features.

A general object of the invention is the provision of an improved construction which will effect a substantially uniform and regular flow of ink to the pen point in normal writing operation, including an immediate supply when writing is started, and at the same time avoid flooding or excessive feed to an extent likely to produce blotting or dropping of ink from the pen point under conditions normally occurring in the handling and use of the pen.

Another object is the provision of improved construction which will facilitate and induce the clearing of excess ink from the feed parts and its return to the reservoir when the pen is inverted, i. e., in the position in which it is normally carried in the pocket with the pen point upward.

Other and further objects and advantages of the invention will be pointed out or indicated hereinafter or will be apparent to one skilled in the art upon an understanding of the invention or employment of it in use.

For the purpose of explaining the nature of the invention, I show in the accompanying drawing forming a part of this specification, and hereinafter describe, one form in which it may be embodied. It is to be understood, however, that this is presented merely for purpose of illustration, and hence is not to be construed in any fashion for the purpose of limiting the appended claims short of the true and most comprehensive scope of the invention in the art.

In said drawing:

Fig. 1 is a longitudinal section of the lower portion of a pen barrel and feed section with a pen point of conventional type shown also in section and a feed bar in side elevation, same serving to illustrate certain features of my improved construction in positions which they occupy when the pen is in normal writing position;

Fig. 2 is a similar section, showing the complete pen section in longitudinal section on a diameter, but with the feed bar in section on a different plane, the line of section being indicated generally by the irregular section line 2—2 of Fig. 5;

Fig. 3 is a part sectional view similar to Fig. 1 but showing parts of the feed bar broken away and with the pen in the inverted position, viz., with the pen point upward, such as it normally occupies when carried in the pocket;

Fig. 4 is a view of the feed bar by itself, as seen from the under side, viz., the side which is downward when the pen is in the normal writing position; and

Fig. 5 is a sectional view on approximately lines 5—5 of Figs. 1 and 2, showing the end of the pen section sleeve in elevation, same being on a larger scale than the other figures.

The illustrative embodiment shown in the drawing will now be described. The reference numeral 10 designates the pen barrel, which may be of conventional tubular form, and has the pen section 10*a* which may be formed separately in the first instance and is suitably secured in the portion 10. For purpose of convenience, I shall use the terms "forward" and "forwardly" to indicate the direction toward the writing tip of the pen and the terms "rear" and "rearward" to indicate the opposite longitudinal direction. In the barrel is provided an ink reservoir, and, if the pen is of the self-filling type, suitable filling means, here represented by the conventional elastic ink sac 11 and presser bar 12. The feed bar is designated generally by the reference numeral 14, and is mounted in the pen section in underlying relationship to the pen point 15, which may be of conventional type with resiliently flexible nibs 15*a* and pierce or breather hole 15*b*. The butt or rearward portion of the feed bar may be of generally cylindrical form and of such diameter that, together with the shank of the pen point, it fits tightly in the bore of the pen section excepting immediately adjacent the lateral margins of the pen point, where narrow crevices 16 are left between the periphery of the feed bar and the bore wall, and in the areas of shallow grooves 17 formed in the bore wall and encompassing the feed bar. In the illustration the depth of these grooves 17 is somewhat exaggerated.

In its upper side, viz., the side which is away from the paper when the pen is in normal writing position, the feed bar is formed with a pair of narrow ink feed grooves 18 which extend longitudinally of the bar from a point 18*a* near its tip to and through its butt end, thus leaving between said ink feed grooves a narrow longitudinally extending rib 19. In the lower end portion of this rib 19 and into the medial portion of the bar beyond it toward the tip end is cut a narrow kerf 20, which terminates just short of the tip end of the feed bar. In the lower end portion of the feed bar the upper part of the rib 19 is cut away on a longitudinally extending arc as at 19*a* to form a depression, and from the rearward ter-

minus of this depression the upper surface of the rib 19 gradually approaches the top line of the feed bar as the rib continues rearwardly, until, in the rearward or butt portion of the feed bar, there remains only a very shallow space between the top of the rib and a plane tangent to the top surface of the bar. This shallow space is designed to serve as a restricted passage for air, and short of the rear end of the feed bar a bore 21 extends radially of the feed bar from the top of the rib 19 to a longitudinal bore 22 which opens at the rear end of the bar. In the bore 22 is seated a small diameter tube 24 which extends rearwardly in the barrel in spaced relationship to the encompassing barrel wall. From the rear end of this tube extends a leader strip 25 which has its rearward end bent outwardly into contact with the reservoir wall. This leader strip may be formed of a segmented extension of the tube. The bore of the tube 24 communicates with the ink chamber of the barrel and reservoir and with the radial bore 21.

In its upper portion, laterally of the ink feed slots 18, the feed bar is provided with longitudinally extending lateral recesses 26 which are separated from said slots by walls 27 upon whose upper ends the pen point bears closely. The rearward terminations of the recesses 26 are formed by the wall portions 26a which extend obliquely toward the tops of the walls 27. The feed bar is provided also with lower lateral recesses 28 extending longitudinally of it below the recesses 26, from which they are separated by ledges 29. The rearward ends of the recesses 28 are formed by outwardly curving wall portions 28a. As seen in Fig. 5, the upper lateral recesses 26 extend considerably more deeply into the feed bar than do the lower lateral recesses 28, and as seen in Figs. 1 and 4, the rearward portions of the upper and lower lateral recesses at respective sides of the feed bar are in communication with each other through flow passages 29a which are as deep as the lower recesses, and adjacent their forward ends said recesses are connected by shallow vent passages 29b which extend into the ribs 29 for only a fraction of its width.

In its under side, the feed bar is provided with a pair of narrow longitudinal grooves 30, thus leaving a longitudinal spline 31 between them and a pair of lower longitudinal walls 32 separating them from the lower recesses 28. From a point about the middle of the length of the feed bar, the spline 31 is cut away to form a pocket 34, the rearward portion of which is gradually reduced in depth until it meets the peripheral surface of the bar. The forward end of the feed bar is undercut diagonally from the tip at the upper side of the bar to the under side of the bar and finished with a smooth surface, and at a short distance rearwardly from its diagonal forward end surface 35 a diagonal slot 36 is cut into each side of the bar to the depth of the spline 31. At their forward ends, these slots 36 begin at the upper surface of the bar at a location slightly forward from the terminus of the ink feed slots 19, and at their rearward or lower ends these slots 36 merge into the longitudinal grooves 30. These slots 36 thus actually extend inwardly of the bar beyond the ink feed grooves 19, but have no communication with them, and they intersect the lower lateral recesses 28 and extend completely through the downwardly directed walls 32.

The forward end of the pen section is funneled or has a counterbore providing a gutter 37 encompassing the feed bar, and the feed bar is mounted in the pen section so that the flow notches 29a are partly in this gutter and partly within the bore of the pen section rearwardly thereof where they may be within the compass of one or more of the grooves 17. The pen point is mounted in such relationship to the feed bar that its nibs bear upon the tip of the latter beyond the forward ends of the ink feed grooves 18 and upon the tops of the forward portions of the walls 27 and with the pierce 15b at a substantial distance rearwardly from the forward terminals of the feed grooves 18 but preferably somewhat forwardly from the deepest point of the depression 19a. The arched pen point envelops the upper portion of the feed bar down to approximately the lower surfaces of the lateral ledges 29, as indicated in Fig. 5. With the parts thus mounted in the pen section, the narrow crevices 16 which are between the periphery of the feed bar and the bore of the pen section adjacent the margins of the pen point are in communication with the gutter 37 and a plurality of said grooves 17.

For an explanation of the operation of the device, we will assume that the reservoir contains an adequate amount of ink for writing. When the pen is in writing position, as represented approximately in Fig. 2, the ink will flow by gravity through the bore of the pen section to the rear end of the feed bar and will be fed by capillary attraction through the ink feed grooves 18 to the nibs of the pen point at the forward end of said grooves and the depression 19a during such time as ink is being drawn from the nibs by the paper in the operation of writing. Since the reservoir has no air inlet other than through the passages of the feed bar, ink outflow, under normal writing conditions, is dependent on admission of air through the feed bar passages, and such inlet of air through the narrow ink feed passages 18 and narrow crevices 16 is precluded by the viscosity or filming effect of the ink. Consequently, the only passage which is available for inlet of air is the passage of larger cross section which is above the rib 19. I make this passage small in its rearward portion so that it will pass air in only very small volume, but to insure free release of the air from this passage into the reservoir, I provide two air discharge paths, one afforded by the opening of this passage at the rear end of the feed bar and the other by way of the bores 21, 22 and tube 24. It is possible to proportion the flow capacities of these two paths in such fashion that approximately one-half of the admitted air will be released within the barrel from each. As compared with a single air inlet of relatively large capacity, this attains two desirable effects. In the first place, it greatly reduces the possibility of air lock, and in the second place, it tends to effect the release of the admitted air in smaller installments and at more frequent intervals. In other words, the air leaves the feed bar in smaller bubbles, but these bubbles come more frequently. As a consequence, the feed of ink is rendered more regular and more uniform under normal conditions, and there is not the likelihood of either engorging the ink and air feed passages, or of "starving" the pen, as there is when the air is released within the barrel in larger and less frequent installments. Furthermore, because this permits the air passage above the rib 19 to be made of very small cross-sectional area in its rearward parts, it affords less possibility for the ink to run down that passage by gravity,

and on this account, greatly reduces the possibility of ink being shaken from the pen.

It is to be recognized, however, that there are various circumstances normally occurring in the use of a fountain pen which do produce a feed of ink in excess of writing requirements. One of these is the thermal expansion of air above the column of ink in the reservoir which is quite likely to occur when the pen is taken into the warm hand from the pocket or from the desk where it has been in a cooler environment. A similar but more pronounced ink expelling effect may be induced when the pen is in use in an airplane which is rapidly gaining altitude. The various features of the present construction enable the pen to meet these conditions without flooding to the extent of dropping ink. In an instance of slight excess feed, as from the thermal influence of the hand, the superfluous drop or flow of ink may be accommodated in the depression 19*a* and the portion of the air passage rearwardly adjacent the same. This will have the effect of closing the breather hole 15*b* and thus preventing inlet of any air to the barrel until the excess ink in the feed bar has been used in the writing. When the excess exceeds the capacity of these parts, a portion of it can pass to the recesses 26 incident to the flexing of the pen nibs away from the walls 27, and the ink reaching recesses 26 will normally distribute itself longitudinally therein due to its capillary adhesion and creeping effect in the narrow reentrant corners of these recesses. If the excess of ink is quite substantial, a quantity of it may reach the diagonal slots 36, by overflow along the top of the walls 27 under the flexed nibs. These slots 36 are of width such that the ink will have pronounced capillary clinging effect in them, and since they are approximately horizontal when the pen is in writing position, they afford the ink free opportunity to distribute itself throughout their length and to reach the bottom grooves 30, which are likewise of width to retain ink by its capillary filming characteristics. The lower lateral recesses 28 afford further holding spaces for ink which may overflow the normal feed channel, and the effective depth of these recesses is augmented by the adjacent margins of the pen point, as seen in Fig. 5, so that a quite substantial quantity of ink may be held suspended as indicated, for example, by the dot and dash lines in Fig. 5.

Not only is my improved feed thus capable of catching and holding a very considerable quantity of ink which may be fed in excess of the writing requirements, but it also induces the feed of such ink to the pen point in the writing operation. Ink in the bottom grooves 30 finds a natural path of flow to the nibs by way of the diagonal slots 36. Recesses 28 have flow outlet to slots 36 where they are intersected by same, and ink in recesses 26 follows the same route to the nibs after passing through notches 29*b* to the lower recesses 28. The emptying of all of these bottom and lateral ink retaining portions is effected prior to the clearing of breather hole 15*b* by the emptying of depression 19*a*, as the breather hole is toward the forward end of the depression and the ink in slots 36 has freer passage to the nibs than that in depression 19*a*. Since breather hole 15*a* is thus kept closed, there can be no further normal feed of ink from the reservoir until the feed bar is cleared of excess ink in the progress of the writing.

Moreover, in the event the pen is capped and put into the pocket in its customary inverted position, while excess ink remains in some or all of the feed bar passages, such ink will be definitely returned to the reservoir in the course of a short time. How this occurs will be most easily understood by reference to Fig. 3. When the pen is thus inverted, the first effect will be the return of ink to the reservoir 11 from the pen section bore under the influence of gravity. This is insured and the arching of ink in that bore prevented by the leading effect and flow-inducing effect of the tube 24 and leader strip 25. At the same time any ink which is in the depression 19*a* will be led by gravity down the upper surface of the rib 19 and returned to the reservoir by way of the opening 23 of the air admission passage and also by way of the passage 21 and tube 24. An amount of ink remains in the feed channels 18 and in the kerf 20, the latter affording a starting and priming supply for the next use of the pen. Ink in the diagonal slots 36 and bottom grooves 30 flows by gravity into the pocket 34. Ink in lateral recesses 26 flows through the notches 29*a* into the lower lateral recesses 28 and, together with the ink which reaches pocket 34, is discharged into the circumferential grooves 17 of the pen section. Notches 29*b* permit inlet of air to the recesses 26, which facilitates the flow-off of ink through notches 29*a*.

In this fashion all of the ink-holding slots and recesses of the feed bar are cleared of ink. Ink which flows into the circumferential grooves 17 is led to the crevices 16, and through them is gradually returned into the reservoir. Thus there is left on the feed bar no free ink which might be shaken off into the cap.

In addition to the functions above explained, the tube 25 has the further effect of aiding in the filling of the pen upon repeated collapsing and expanding of the sac 11. Since the ink reservoir includes the non-collapsible volume of the pen section bore as well as the collapsible volume of the ink sac 11, it is impossible to fill the entire reservoir with one operation of that sac. After the sac has been once collapsed and distended, however, so that the reservoir is partially filled with ink, a second collapsing of the sac will force ink out through the tube 24 and passage 23 until the level of ink remaining in the reservoir reaches the end of tube 24. Thereupon some of the air remaining in the reservoir will find outlet through that tube as the compression of the sac continues, without ejecting the remainder of the ink from the reservoir. Accordingly, this leaves the pen section bore approximately half filled with ink, so that upon the next distension of the sac, the reservoir will be almost completely filled.

What I claim is:

1. In a fountain pen having a barrel affording an ink reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and formed with an ink feed groove extending continuously from a point near the tip of the feed bar through its rearward end, said feed bar being formed also to afford an air passage extending longitudinally thereof immediately under the pen point and communicating with said ink feed groove, said air passage being of diminished size in the rearward portion of the feed bar to afford a restricted inlet into the ink reservoir, said feed bar being provided with a second air passage of restricted flow capacity leading from the diminished por-

tion of said first air passage and opening into the reservoir rearwardly of the feed bar at a location spaced from the encompassing barrel wall.

2. In a fountain pen, a construction as specified in claim 1 and wherein the first mentioned air passage is of increased depth in the forward portion of the feed bar to afford a recess of substantial capacity under the forward portion of the pen point, said recess being in communication with the ink feed groove.

3. In a fountain pen, a construction as specified in claim 1 and wherein the first mentioned air passage is of increased depth in the forward portion of the feed bar to afford a recess of substantial capacity under the forward portion of the pen point, said recess being in communication with the ink feed groove and increasing in depth rearwardly of the pierce of the pen point.

4. In a fountain pen, a construction as specified in claim 1 and wherein said second restricted air passage is defined in part by a slender tube extending rearwardly from the rear end of the feed bar and spaced throughout its length from the encompassing wall of the barrel.

5. In a fountain pen having a barrel affording an ink reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and formed with an ink feed groove and an air inlet passage both extending longitudinally of it immediately under the pen point, the air passage being of diminished cross-sectional size in its rearward portion, said feed bar being provided with a second air passage which is of restricted size and which leads into the reservoir from the diminished portion of said first mentioned air passage, said second air passage being formed in part by a slender tube extending rearwardly from the feed bar in spaced relationship to the encompassing reservoir wall, and a leader strip continuing rearwardly from the end of said tube in the reservoir.

6. In a fountain pen, a structure as specified in claim 5 and wherein the rearward portion of said leader strip is deflected outwardly into association with a portion of the reservoir wall.

7. In a fountain pen having a barrel affording an ink reservoir and a pen point secured in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and formed in its upper portion with an ink feed groove for leading ink from the reservoir to the forward under portion of the pen point, said feed bar being provided also with lateral slots extending diagonally rearward from locations spaced forwardly from and out of communication with the ink feed groove, said feed bar being provided also with a pocket of substantial capacity formed in its lower side and opening outwardly within the portion of the barrel in which the feed bar is seated, said feed bar being further provided with longitudinal grooves affording channels of communication between said diagonal slots and said pocket; said diagonal slots and longitudinal grooves being formed to facilitate capillary flow of ink in them.

8. In a fountain pen, a structure as specified in claim 7 and wherein said lateral slots are disposed at an angle relative to the longitudinal axis of the feed bar such that they extend in approximately horizontal directions when the pen is held in normal writing position.

9. In a fountain pen, a structure as specified in claim 7 and wherein the rearward portion of said pocket is in communication with the reservoir through a restricted passage.

10. In a fountain pen, a structure as specified in claim 7 and wherein the portion of the barrel in which the feed bar and pen point are seated is provided with one or more shallow internal grooves extending from said pocket to locations adjacent the lateral margins of the pen point.

11. In a fountain pen, a structure as specified in claim 7 and wherein the portion of the barrel in which the pen point and feed bar are seated is provided with one or more shallow internal grooves encompassing the shank of the pen point and the portion of the feed bar containing said pocket.

12. In a fountain pen having a barrel affording an ink reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and formed with an ink feed groove extending longitudinally of it immediately under the pen point, said feed bar being provided with a pocket of substantial capacity formed in its lower portion and extending partly within the barrel, said feed bar being formed also with lateral recesses extending longitudinally thereof intermediate the feed groove and pocket, said recesses being formed to induce capillary flow of ink therein and having communication with said pocket but not with said ink feed channel.

13. In a fountain pen, a structure as specified in claim 12 and wherein the portion of the barrel in which the pen point and feed bar are seated is formed with one or more shallow internal grooves running in the circumferential direction and having communication with at least some of said recesses.

14. In a fountain pen, a structure as specified in claim 12 and wherein the portion of the barrel in which the pen point and feed bar are seated is provided with one or more shallow internal grooves running in circumferential directions and communicating with said pocket and having restricted communication with the barrel reservoir.

15. In a fountain pen having a barrel affording an ink reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and formed with an ink feed groove extending longitudinally of it immediately under the pen point, said feed bar being formed also with lateral recesses extending longitudinally thereof, said recesses being formed to induce capillary flow of ink therein and having their rearward portions extending into the barrel, the barrel portion which encompasses said rearward portions of the recesses being formed with one or more shallow grooves extending in circumferential directions and having restricted communication with the reservoir.

16. In a fountain pen, a structure as specified in claim 15 and wherein said longitudinal recesses comprise an upper one and a lower one in each side of the feed bar and in communication with each other adjacent their forward and rearward ends.

17. In a fountain pen having a barrel affording a reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in operative association with the pen point and formed with an ink and air feed passage extending from the reservoir to the forward portion of the pen point, a slender tube seated in the feed bar and extending rear-

wardly therefrom in spaced relationship to the encompassing reservoir wall, the bore of said tube having restricted communication with said feed passage and having a rear opening in the reservoir, and a leader strip extending rearwardly in the reservoir from adjacent the rear opening of said tube.

18. In a fountain pen having a barrel affording an ink reservoir and a filling device for increasing and decreasing the effective volume of the reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in cooperative relationship to the pen point and having a longitudinal passage for leading ink from the reservoir to the forward end of the pen point and conducting air to the reservoir, a slender tube seated in the feed bar and extending for a short distance rearwardly therefrom within the reservoir and in spaced relationship to its encompassing wall, said tube having restricted communication with said longitudinal ink passage and opening at its rearward end within the barrel, and a leader strip extending rearwardly from said tube within the reservoir.

19. In a fountain pen having a barrel affording an ink reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and having a longitudinal passage for leading ink from the reservoir to the forward portion of the pen point, the feed bar being provided also with a pocket which is out of communication with said passage and which extends into the end of the barrel and with a longitudinal slot leading from the forward portion of the pen point to said pocket for conducting to the latter ink which overflows from said passage, the parts being arranged to provide a narrow crevice leading into the reservoir along the feed bar adjacent a margin of the pen point, and a restricted circumferentially directed groove connecting the pocket with said crevice within the barrel.

20. In a fountain pen having a barrel affording an ink reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and having a longitudinal passage for leading ink from the reservoir to the forward portion of the pen point, the feed bar being provided also with a pocket which is out of communication with said passage and which extends into the end of the barrel and with a longitudinal slot leading from the forward portion of the pen point to said pocket for conducting to the latter ink which overflows from said passage, the parts being arranged to afford a restricted tortuous ink-return passage leading from the rearward portion of the pocket to the reservoir to permit drainage of ink from the pocket to the reservoir when the pen is upright with the feed bar above the reservoir.

21. In a fountain pen having a barrel affording an ink reservoir and a pen point mounted in and projecting from the end of the barrel, a feed bar mounted in the barrel in underlying relationship to the pen point and having a longitudinal passage for leading ink from the reservoir to the forward portion of the pen point, the feed bar being formed also with a recess which is out of communication with said passage but arranged to receive ink overflowing therefrom, said recess extending into the end of the barrel and having a restricted path of communication with the reservoir permitting drainage of ink from the recess to the reservoir when the pen is in upright position with the feed bar above the reservoir.

GEORGE E. ZIEGLER.