April 28, 1959 H. W. SAMS 2,883,969

LARGE CAPACITY BALL POINT INK RESERVOIR TUBE

Filed Sept. 15, 1954

2 Sheets-Sheet 1

Fig. 1

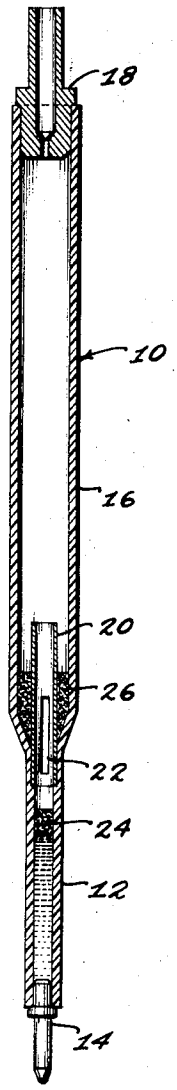


Fig. 2

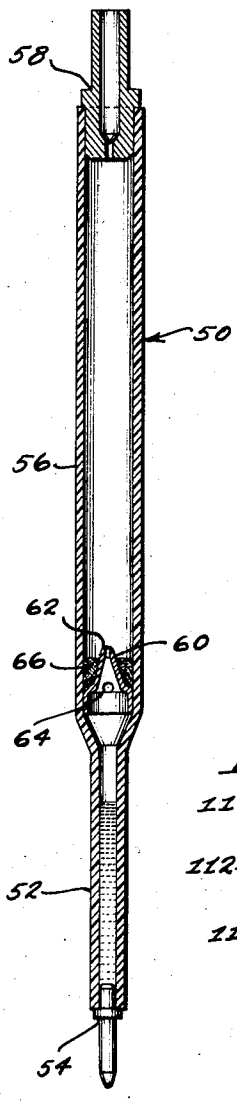


Fig. 3

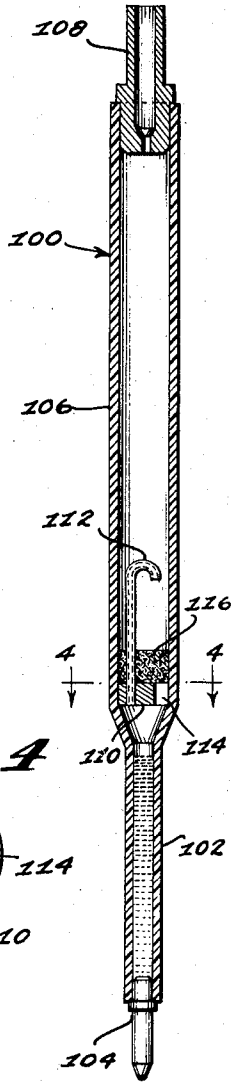
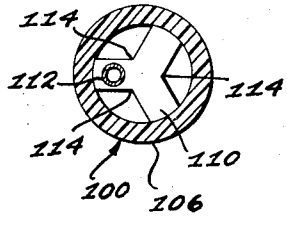


Fig. 4



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Fig. 5

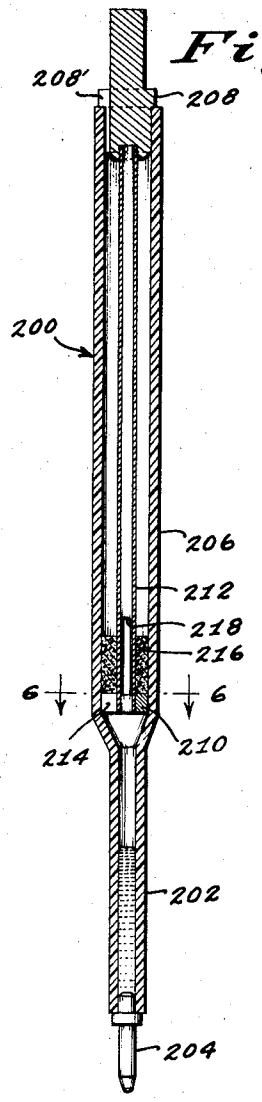


Fig. 7

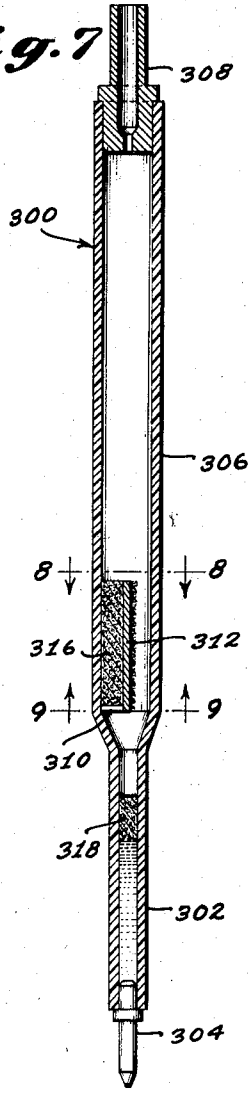


Fig. 9

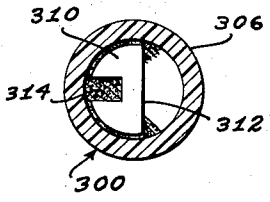


Fig. 6

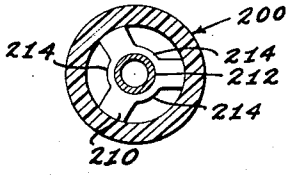
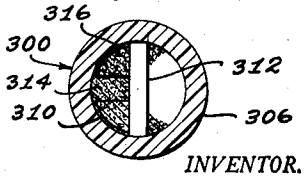


Fig. 8



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LARGE CAPACITY BALL POINT INK RESERVOIR TUBE

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Application September 15, 1954, Serial No. 456,268

9 Claims. (Cl. 120—42.4)

This invention relates to writing instruments of the ball point type and more particularly to a large capacity ball point ink reservoir tube adapted for containing ball point ink together with a grease seal follower therefor.

It is highly desirable to provide ball point pens with ink tubes having as large a capacity as possible so as to extend the writing life of the pen, or reduce the frequency with which the ink tubes must be replaced in pens that are arranged for using refill units. In large capacity ink tubes, however, capillary diameters are normally exceeded so that special means are necessary to prevent rear end leakage. This problem of rear end leakage is encountered to a serious extent with ball point inks in general when the inner diameter of the ink tube is increased beyond about 0.128", and this diameter will be exceeded substantially if the capacity of the ink tube is increased to ocupy fully the space available within the normal ball point pen barrel, as is desirable.

We have found that a very effective seal for preventing ink leakage in a large capacity ink tube of this sort can be provided by using a fluid seal, that has a higher resistance to flow than the ink, as a follower for the ink in the tube. This fluid seal can be formed by a small deposit of grease placed in the rear end of the ink tube, and excellent results are obtained by using for this purpose a grease manufactured by Famous Lubricants, Inc., and identified as Orange Solid Oil No. 2.

The use of such a grease seal, however, creates a further problem of arranging for complete feeding of ink from the ink tube. Large capacity ink tubes must necessarily be reduced in diameter adjacent their forward end in order to extend through the restricted space at the tapered writing point of a pen barrel, and it is advantageous to reduce this forward ink tube portion to capillary dimensions so that it may be fitted in the usual manner with a ball point insert. The grease seal serves nicely as a follower to provide for feeding of ink from the large diameter portion of the ink tube, but when the change in diameter to the reduced forward portion is reached the high resistance to flow of the grease seal material prevents it from entering this forward portion with the ink, and the result is to plug the ink tube at this point with grease seal material so that the ink in the forward portion cannot be fed.

According to the present invention means is provided for disposition at the change in diameter within a large capacity ink tube that acts to trap the grease seal material so as to allow complete feeding of ink from the forward small diameter portion of the tube as well as the rear portion thereof. This means of the present invention operates to vent the forward ink tube portion rearwardly past the trapped grease seal material and thereby allow normal feeding of the ink to continue until the ink supply is completely exhausted, as described further in connection with the several representative embodiments illustrated in the drawings, in which:

Fig. 1 is a longitudinal section of a large capacity ball point ink tube embodying the present invention;

Fig. 2 is a similar longitudinal section showing a modified embodiment of the ink tube of the present invention;

Fig. 3 is a further longitudinal section illustrating a third embodiment of the present invention;

Fig. 4 is a sectional detail taken substantially on the line 4—4 in Fig. 3;

Fig. 5 is an additional longitudinal section of a fourth embodiment of the present invention;

Fig. 6 is a sectional detail taken substantially on the line 6—6 in Fig. 5;

Fig. 7 is another longitudinal section of a fifth embodiment of the present invention;

Fig. 8 is a sectional detail taken substantially on the line 8—8 in Fig. 7; and

Fig. 9 is a sectional detail taken substantially on the line 9—9 in Fig. 7.

In Fig. 1 of the drawings, the embodiment illustrated comprises an ink tube, as indicated generally by the reference numeral **10**, having a relatively small diameter forward portion **12** of a size adapted for fitting with a conventional ball point insert **14**. This forward small diameter portion **12** of the ink tube **10** is formed in a relatively short length just sufficient to extend through the restricted space at the tapered writing point of a ball point pen barrel, and rearwardly of this forward portion **12** the ink tube **10** flares outwardly to an enlarged diameter as at **16** for the remainder of its length to form a large capacity ink reservoir having the rear end thereof fitted with a vent plug **18**. This enlarged diameter rear portion **16** of the ink tube **10** is proportioned in size to fill substantially the interior of the ball point pen barrel in which it is used and thereby take advantage of the full capacity available within the pen barrel for storing ink.

Because of the enlarged diameter of the rear ink tube portion **16**, a grease seal is used therein, as previously mentioned, to provide for proper ink feeding and to avoid ink leakage; and the ink tube **10** is further fitted according to the present invention with an insert **20** for trapping the grease seal at the junction of the enlarged rear portion **16** with the forward ink tube portion **12** of restricted diameter, and by which insert **20** the grease seal is prevented from plugging the ink tube **10** at this point because of its inability to enter the small diameter forward portion **12**.

For this purpose, the insert **20** comprises a relatively short tube inserted at the rear end of the forward ink tube portion **12** and extending rearwardly into the larger diameter rear ink portion **16**, as shown. The walls of the tube forming the insert **20** are formed with a single slot or a series of slots as at **22** that extend for a short distance into the reduced diameter portion **12** as well as being exposed rearwardly in the large diameter rear portion **16**. With this arrangement, when the grease seal moves downwardly in the ink tube **10** upon feeding of ink therefrom sufficiently to reach the insert **20**, a cylindrical section **24** is cut out of the grease seal and continues to move downwardly into the small diameter forward portion **12** for completion of the feeding of ink therefrom. The remainder of the grease seal is trapped exteriorly of the insert **20** as illustrated at **26**, as the longitudinal insert slots **22** are formed in a size small enough to prevent flow of the viscous grease seal material therethrough, although being sufficiently large to allow feeding of ink readily until the ink supply in the large diameter rear ink tube portion **16** is entirely exhausted.

The modified embodiment illustrated in Fig. 2 of the drawings comprises a substantially similar ink tube **50** having a small diameter forward portion **52** fitted with a ball point insert **54**, and an enlarged diameter rear portion **56** fitted with a rear vent plug **58**, but having a different form of insert **60** for trapping the grease seal when the ink supply from the enlarged capacity rear ink

tube portion 56 is exhausted. This trapping insert 60 comprises a conical shaped spreader disposed at the forward end of the ink tube 50 and having a rear vent hole 62 at its apex with feed holes 64 spaced circumferentially adjacent its base through which ink may flow from the rear tube portion 56 but which are small enough to prevent flow of grease seal material therethrough. The action of this insert 60 is to spread the grease seal about the exterior surface thereof so as to trap it as indicated at 66 in Fig. 2 and thereby allow continued feeding of ink from the small diameter forward ink tube portion 52, as the rear vent hole 62 is uncovered after trapping of the grease seal at 66.

The further modified embodiment illustrated in Figs. 3 and 4 of the drawings, as indicated generally by the reference numeral 100, again comprises an ink tube having a small diameter forward portion 102 with a ball point insert 104 fitted thereto and an enlarged diameter rear portion 106 fitted rearwardly with a vent plug 108 and interiorly at its forward end with a trap plug 110 having a goose-neck tube 112 mounted thereon to extend rearwardly with the goose-neck portion thereof turning forwardly. The goose-neck tube 112 provides an air vent that cannot be plugged by the normal movement of grease seal material within the enlarged capacity rear ink tube portion 106, and which is at all times filled with ink up to the time that the ink supply has been exhausted to the level of the trap plug 110, after which the goose-neck tubs 112 serves as an air vent to allow further complete feeding of ink from the small diameter forward ink tube portion 102. The trap plug 110 is formed with longitudinal feed grooves 114 spaced about its circumference for allowing ink to feed forwardly from the rear tube portion 106, but which are proportioned with a cross section small enough to prevent flow of grease seal material therethrough and which thereby adapt the trap plug 110 to trap the grease seal material as illustrated at 116 in Fig. 3.

In Figs. 5 and 6 of the drawings, the additional embodiment shown is indicated generally by the reference numeral 200, and this embodiment incorporates in common with the previous embodiments an ink tube having a small diameter forward portion 202, to which a ball point insert 204 is fitted, and an enlarged diameter rear portion 206 fitted rearwardly with a vent plug 208. The vent plug 208 in this case is solid except for at least one peripheral vent groove as at 208' and serves together with a trap plug 210 arranged in fixed relation at the forward end of the rear ink tube portion 206 for supporting a small diameter tube 212 concentrically within the rear ink tube portion 206. The small diameter tube 212 extends centrally through the trap plug 210 and rearwardly therefrom throughout substantially the entire length of the rear ink tube portion 206 to the vent plug 208 at which the rear end of the small diameter tube 212 is closed. The trap plug 210 is formed with longitudinal feed grooves 214 spaced about its circumference for allowing ink to feed forwardly from the rear tube portion 206, but which are proportioned with a cross section small enough to prevent flow of grease seal material therethrough and which accordingly cause the trap plug 210 to trap the grease seal material as illustrated at 216 in Fig. 5. The small diameter tube 212 is further formed with at least one slot as at 218 in the wall thereof, which is likewise proportioned to prevent flow of grease seal material but to allow ink to feed therethrough, and which extends rearwardly from the trap plug 210 beyond the extent of the trapped grease seal material 216 to serve as an air vent for allowing complete feeding of ink from the forward ink tube portion 202 after the grease seal material has been trapped at 216. With the small diameter tube 212 arranged in the above noted manner, it will be seen that the grease seal material in reaching the trapped position illustrated at 216 does not have to

change its shape in any respect from the shape in which it is originally disposed at the rear end of the large diameter ink tube portion 206 as a follower for the ink supply therein.

The fifth embodiment of the present invention illustrated in Figs. 7, 8 and 9 of the drawings, as indicated generally by the reference numeral 300, operates most nearly like the first described embodiment 10 in that it provides for allowing a portion of the grease seal material to follow the ink completely through the ink tube. This embodiment 300 comprises an ink tube with a small diameter forward portion 302 fitted with a forward ball point insert 304 and an enlarged diameter rear portion 306 fitted rearwardly with a vent plug 308. Interiorly, the rear ink tube portion 306 has a baffle member arranged in fixed relation at its forward end which is formed by a segmental circular plug 310 from which a partition plate 312 extends rearwardly from the chord side of the plug 310. The plug 310 is slotted as at 314 to form an ink feed opening proportioned small enough so that grease seal material is prevented from flowing therethrough with the result that a major portion of the grease seal material is trapped as at 316 by the plug 310 at one side of the partition plate 312 upon exhaustion of the ink supply in the rear ink tube portion 306, while the space between the other side of the partition plate 312 and the adjacent wall of the rear ink tube portion 306 forms a channel through which a portion of the grease seal material may feed forwardly as at 318 to follow the ink through the forward ink tube portion 302, and after which this channel provides an air vent allowing the ink to feed completely from the forward ink tube portion 302.

The present invention has been described in detail above for purposes of illustration only and is not intended to be limited by this description or otherwise except as defined in the appended claims.

I claim:

1. A large capacity ball point ink reservoir tube vented at its rear end containing a supply of ball point ink and a fluid follower seal disposed rearwardly of said ink supply that has a higher resistance to flow than the ink, said ink tube being characterized by a relatively short forward portion of capillary diameter fitted with a conventional ball point insert and flared rearwardly to a portion of substantially enlarged non-capillary diameter extending for the remainder of the tube length, and by a follower trap insert disposed interiorly within the tube adjacent the forward end of the rear enlarged diameter portion of said tube for separating said fluid seal material so as to allow complete feeding of ink from the forward portion of said tube as well as the rear portion thereof, said follower trap insert comprising a baffle member fixed within said tube and having at least one forward opening therein of a cross section sufficiently large to allow ink flow therethrough but small enough to prevent such flow of said fluid follower seal material, and said baffle member being further arranged for providing a rear vent opening adapted so to extend rearwardly of the fluid follower seal material after separation by said follower trap insert to allow the ink supply remaining within the forward capillary portion of said reservoir tube to be fed to the point.

2. A large capacity ball point ink reservoir tube vented at its rear end containing a supply of ball point ink and a grease seal follower disposed rearwardly of said ink supply, said ink tube being characterized by a relatively short forward portion of capillary diameter fitted with a ball point insert and flared rearwardly to a portion of substantially enlarged non-capillary diameter extending for the remainder of the tube length, and by a follower trap insert disposed interiorly adjacent the forward end of the rear portion of said follower tube, said trap insert comprising a baffle member fixed within said tube and having at least one forward opening therein of a cross

section sufficiently large to allow complete ink flow therethrough from the rear to the forward portion of said tube but small enough to prevent such flow of grease seal material, and said baffle member being further arranged for providing a rear vent opening adapted so to extend rearwardly of the grease seal material after separation thereby for venting the forward portion of said tube to the rear portion thereof for complete feeding of ink from said forward portion.

3. A large capacity ball point ink reservoir tube as defined in claim 2 and further characterized in that said baffle member is formed by a relatively short tubular element inserted in fixed relation at the rear end of the forward portion of said ink tube and extending rearwardly into the rear enlarged diameter portion thereof with at least one slot in the wall of said tubular element extending for a short distance into the forward ink tube portion as well as being exposed in the rear enlarged diameter portion thereof to form said forward baffle member opening.

4. A large capicity ball point ink reservoir tube as defined in claim 2 and further characterized in that said baffle member is formed by a conical element inserted in fixed relation at the forward end of the rear portion of said ink tube and tapering rearwardly therein with a series of said forward baffle member openings spaced circumferentially adjacent the base thereof and said rear vent opening located at the apex thereof.

5. A large capacity ball point ink reservoir tube as defined in claim 2 and further characterized in that said baffle member is formed by a circular plug element inserted in fixed relation at the forward end of the rear portion of said ink tube with longitudinal grooves spaced circumferentially in said plug element to form a series of said forward baffle member openings and with a gooseneck tube extending rearwardly through said plug element and turning forwardly within the rear portion of said ink tube to form said rear vent opening.

6. A large capacity ball point ink reservoir tube as defined in claim 2 and further characterized in that said baffle member is formed by a circular plug element inserted in fixed relation at the forward end of the rear portion of said ink tube with longitudinal grooves spaced circumferentially in said plug element to form a series of said forward baffle member openings and with a small diameter tube extending rearwardly through said plug element and throughout substantially the entire extent of said rear ink tube portion, said small diameter tube having the rear end thereof closed and having at least one slot in the wall thereof extending rearwardly from said plug element sufficiently to form said rear vent opening.

7. A large capacity ball point ink reservoir tube as defined in claim 2 and further characterized in that said baffle member is formed by a segmental circular plug inserted in fixed relation at the forward end of the rear portion of said ink tube with a partition plate extending

rearwardly within said rear ink tube portion from the chord side of said plug, said plug being slotted to form said forward baffle member opening at one side of said partition plate and the space between the other side of said partition plate and the adjacent wall of said rear ink tube portion providing said rear vent opening.

8. A large capacity ball point ink reservoir tube vented at its rear end containing a supply of ball point ink and a grease seal follower disposed rearwardly of said ink supply, said ink tube being characterized by a relatively short forward portion of capillary diameter fitted with a ball point insert and flared rearwardly to a portion of substantially enlarged non-capillary diameter extending for the remainder of the tube length, and by separate means disposed interiorly adjacent the forward end of the rear portion of said tube for separating sufficient grease seal material thereat and having an opening adapted so to extend rearwardly of the grease seal follower after separation for maintaining the forward portion of said tube vented to the rear portion thereof so that feeding of ink from said forward portion can be completed upon exhaustion of the ink supply from the enlarged diameter rear portion thereof.

9. A large capacity ball point ink reservoir tube vented at its rear end containing a supply of ball point ink and a grease seal follower disposed rearwardly of said ink supply, said ink tube being characterized by a relatively short forward portion of capillary diameter fitted with a ball point insert and flared rearwardly to a portion of substantially enlarged non-capillary diameter extending for the remainder of the tube length, and by separate follower trap means disposed interiorly adjacent the forward end of said enlarged diameter rear tube portion having an opening at the rear end thereof adapted so to extend rearwardly of the grease seal follower after separation for maintaining the forward tube portion vented to said rear portion and for selectively separating sufficient grease seal material thereat to allow complete feeding of ink from said forward portion upon exhaustion of the ink supply from said enlarged diameter rear tube portion.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,883,969 April 28, 1959

Herbert W. Sams

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 73, strike out "follower" and insert the same after "said", second occurrence, same line.

Signed and sealed this 1st day of September 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents