July 8, 1952 J. A. SMITH 2,602,423

FOUNTAIN PEN

Filed Nov. 15, 1946

Fig. 2.

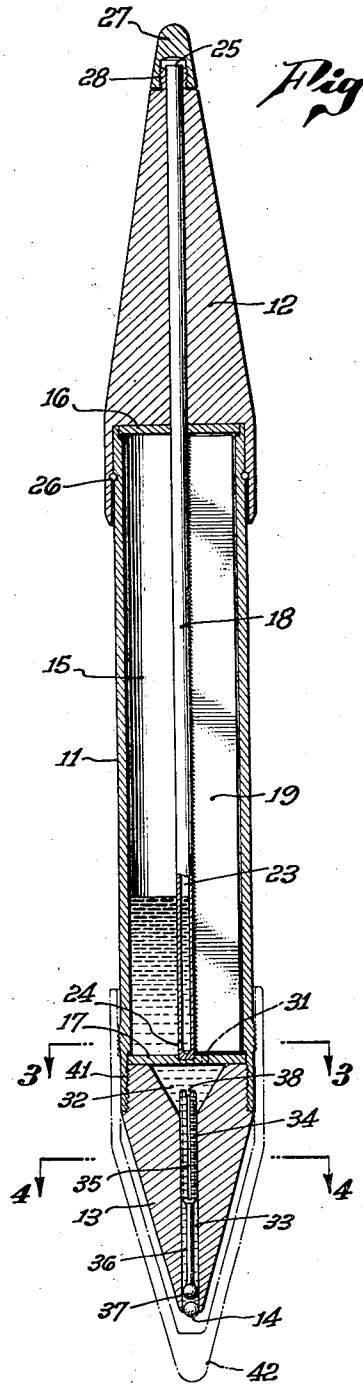


Fig. 1.

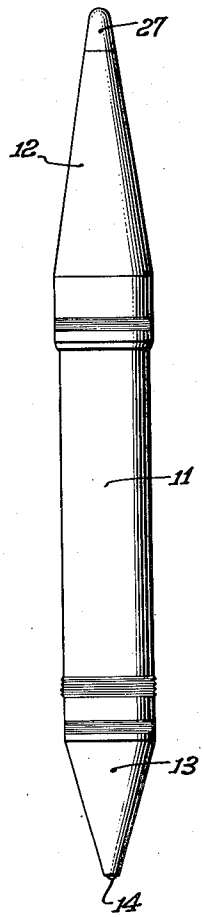


Fig. 3.

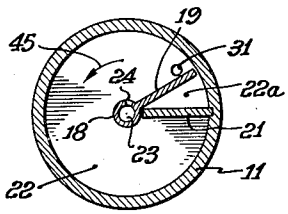


Fig. 3a.

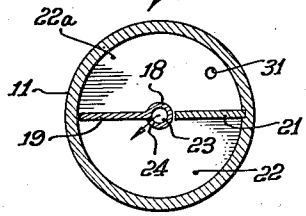


Fig. 3b.

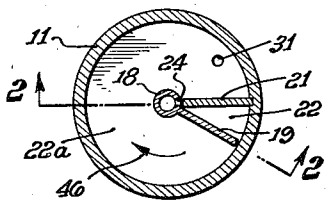
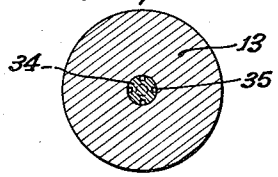


Fig. 4.



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FOUNTAIN PEN

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8 Claims. (Cl. 120—46)

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This invention relates to fountain pens, and is directed particularly to an improved arrangement for filling the ink reservoir.

A major consideration in fountain pen design is the provision of an ink reservoir of maximum capacity for a barrel of given size. It is also desirable, but seldom possible because of inherent shortcomings in the filling arrangement, to fill the reservoir completely. It is a general object of this invention to provide a construction wherein the interior of the barrel is utilized to the maximum extent as an ink reservoir, and to provide a filling arrangement which is capable of filling the reservoir completely.

It is a further object of this invention to provide a fountain pen embodying an ink reservoir having an ink intake passage which is independent of the ink outlet passage which feeds the pen point, thereby permitting the use of unidirectional flow type of pen point such as, for example, a ball point.

It is another object of this invention to provide a fountain pen embodying an ink reservoir which may be completely filled with ink by successive pumping strokes in a continuous operation.

It is still another object of this invention to provide a fountain pen in which the reservoir may be completely filled by a comparatively simple manipulation which may be easily performed without disturbing the relationship of the ink intake opening to the ink supply.

This invention possesses many other advantages and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present specification. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

In accordance with this invention the pen barrel is constructed with a rotatable vane extending axially the full length of the barrel reservoir, and cooperating with a stationary radial partition extending inwardly from the barrel wall to form an expansible ink receiving chamber. A first ink passage is provided communicating between the chamber and the upper end of the pen, and a second ink passage is provided communicating between the chamber and the pen point. Preparatory to filling the chamber, the vane is first rotated in one direction until the chamber is of minimum volume. The pen is then inverted, the end including the first passage orifice is dipped into an ink supply, and the vane is rotated in the opposite direction to expand the

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chamber and create a partial vacuum therein to draw ink into the barrel reservoir.

The second passage, communicating with the pen point, is so positioned that during the filling operation it is isolated from the ink chamber, being brought into registry with the ink chamber only when the vane has been rotated to its final position providing maximum volume of the chamber. In this manner, the pen point ink passage is ineffective to break the suction created in the ink chamber during the filling operation.

The vane is preferably mounted on a hollow, central shaft, the conduit in the shaft forming an ink inlet passage communicating between the ink chamber and the upper exterior end of the pen. A port communicates between the shaft passage and the chamber near that end of the barrel adjacent the pen point, so that the ink, upon flowing into the chamber, drops away from the port, thereby permitting repeated pumping of the vane until the barrel reservoir is full of ink.

Referring now to the drawings:

Figure 1 is an elevational view of the pen;

Figure 2 is an enlarged, longitudinal sectional view taken along line 2—2 of Figure 3*b* and showing the ink receiving reservoir in the pen barrel;

Figures 3, 3*a* and 3*b* are sectional views taken along line 3—3 in Figure 2, illustrating three different positions of the rotatable vane which effects expansion and contraction of the ink receiving chamber; and

Figure 4 is a sectional view taken along line 4—4 of Figure 2.

Referring to Figures 1 and 2, the pen comprises in general a cylindrical barrel 11 having a tapered extension 12 rotatably mounted on the upper end thereof and having a pen point 13 secured to the lower end thereof. The pen point may be of the ball type, including a writing ball 14 protruding slightly from the tip.

The interior of the barrel 11 constitutes an ink reservoir 15 extending throughout substantially the entire length thereof, being closed at its upper end by a transverse partition 16 secured in sealed relation to the barrel by the extension 12, and being closed at its lower end by a transverse partition 17 similarly secured to the barrel by the pen point 13. A hollow shaft 18 extends the full length of the reservoir in coaxial relation thereto and is journaled at its lower end in the partition 17. The shaft extends upwardly through a central opening in the upper partition 16 and through the extension 12. The latter is secured to the shaft, as by a press fit, so that the shaft may be rotated by the extension.

A radial vane 19 is secured to the shaft 18 and extends the full length of the reservoir 15. The upper and lower ends of the vane have substantially fluid tight sealing engagement with the respective partitions 16 and 17, and the outer

edge of the vane has slidable sealing engagement with the inner wall of the barrel 11. The vane thus constitutes a rotary piston rotatable about the axis of the shaft 18.

A radial partition 21 (Figure 3) is secured to the barrel and extends radially inwardly into slidable sealing engagement with the shaft 18. The partition 21 extends the full length of the reservoir 15, and cooperates with the vane 19 to divide the reservoir into two separate chambers 22 and 22*a*, the relative volumes of which may be changed by rotation of the vane about its axis.

The interior of the hollow shaft 18 serves as an ink passage 23 which communicates with the chamber 22 through a lateral port 24 adjacent the lower extremity of the shaft. For the purpose of showing the port 24 in Figure 2, it is shown therein as disposed diametrically opposite the vane 19. It will be noted, however, by reference to Figures 3, 3*a* and 3*b*, that the port 24 is located closely adjacent the vane on the side thereof communicating with the chamber 22. The upper end of the passage 23 is open and forms an inlet port 25 through which ink may be drawn from an ink supply into the passage 23 and thence into the chamber 22 upon rotation of the vane.

As previously stated, the extension 12 is nonrotatably secured to the shaft 18 so that the shaft and the vane 19 may be rotated by manual rotation of the extension. The extension is secured to the barrel 11 by a retaining ring 26 which permits relative rotation but prevents axial separation of these elements. The upper protruding end of the shaft 18 may be enclosed within a cap 27 detachably secured, as by a threaded connection 28, to the upper extremity of the extension 12.

An ink outlet port 31 is formed in the lower partition 17 to allow ink to flow from the reservoir 15 into a conical well 32 in the pen point 13. The well 32 communicates with the writing ball 14 through a central axial bore 33, the upper portion of which is threaded to receive an adjustable control plug 34. As shown in Figure 4, the threaded portion of the control plug is provided with a plurality of axially extending external grooves 35 forming ink passages. The lower portion 36 of the plug 34 is of reduced diameter and has formed integrally therewith at its lower end a control ball 37 of a diameter slightly less than that of the bore 33. The control ball limits the inward displacement of the writing ball 14 from its seat in the tip of the point 13, and thus by adjusting the position of the control plug 34 in the bore 33 the flow of ink downwardly around the writing ball may be adjustably controlled. A transverse slot 38 is formed in the head of the plug 34 to facilitate adjustment of the plug.

Referring to Figures 3, 3*a* and 3*b*, it will be observed that the outlet port 31 is so located with respect to the radial partition 21 that it is isolated from the chamber 22 except when the vane 19 is rotated to the final position illustrated in Figure 3. In this manner communication between the chamber 22 and the pen point is cut off during the filling operation, thus preventing intake of air through the pen point, and the port 31 into the chamber 22 which, if it were permitted, would break the suction in the chamber 22 during the filling stroke of the vane. It will also be observed that the port 24 in the shaft 18 is located closely adjacent the vane 19 on the trailing side thereof so as to be in communication with the chamber 22 throughout the pumping stroke of the vane.

The ink reservoir is filled in the following manner:

After removal of the cap 27, the pen is inverted and the inlet port 25 in the protruding end of the shaft 18 is dipped in the ink, the pen being conveniently held in this position by grasping the extension 12. Either the barrel or the extension is then rotated through slightly less than one revolution in the proper direction to effect rotation of the vane 19 relative to the barrel in the direction of the arrow 45 in Figure 3. The vane is thus rotated from the position shown in Figure 3, which is the position it normally occupies during use of the pen, to the position indicated in Figure 3*b*. During this stroke of the vane the air in the chamber 22 is expelled through the port 24, the axial passage 23 and the port 25. Thereafter the vane is rotated in the opposite direction, as indicated by the arrow 46 in Figure 3*b*, to increase the volume of the chamber 22. Inasmuch as the only communication with the chamber 22 during this pumping stroke is through the ports 24 and 25 and passage 23 to the ink supply, the partial vacuum created in the chamber by the increase in volume thereof causes ink to be drawn upwardly through the passage 23 and the port 24 and into the chamber.

Practical design considerations and manufacturing tolerances prevent the formation of a perfect seal between the relatively slidable surfaces defining the chamber 22, and hence there will be some loss of suction during the pumping stroke due to leakage of air from the chamber 22*a* into the chamber 22. Consequently the chamber 22 will not be completely filled with ink by a single pumping stroke of the vane. Additional ink may, however, be drawn into the reservoir by successive pumping strokes until the reservoir is filled. Upon reverse rotation of the vane any air in the chamber 22 above the ink therein is expelled through the ports 24 and 25 and passage 23 and forms bubbles in the ink supply. When the vane reaches a mid-point, as indicated in Figure 3*a*, the volume of the chamber 22 has been reduced to approximately one-half its maximum volume, and, if it be assumed for example that the chamber was half filled with ink during the initial pumping stroke, the chamber will then be completely filled with ink and continued counterclockwise rotation of the vane would expel ink from the chamber. This condition is indicated by the cessation of formation of bubbles in the ink supply. The vane is then rotated from the intermediate position in a clockwise direction to the final position shown in Figure 3. Upon successive repetitions of the foregoing operation the return strokes become successively shorter until the chamber is completely filled. The cap 27 is then applied to close the port 25, and the pen is ready for use.

From the foregoing description of a preferred embodiment of the invention it will be apparent that a fountain pen constructed in accordance therewith possesses several outstanding advantages. Not only is substantially the entire barrel utilized as an ink reservoir, but the filling mechanism is such as to permit the reservoir to be completely filled with ink. A pen of exceptionally large ink capacity is thereby provided. By reason of the small number of parts and their simple and yet rugged construction, the pen is inexpensive to manufacture and is capable of long, trouble-free service.

I claim:

1. In a fountain pen: means forming a circular barrel; transverse end walls respectively closing the opposite ends of said barrel; an element extending axially of said barrel and rotatably supported by said end walls; said element extending beyond one end of said barrel, a fixed radial partition extending longitudinally of said barrel between the end walls and between said element and the wall of said barrel; a rotatable vane secured to said element to rotate therewith, extending longitudinally of said barrel between the end walls, and between said element and said wall, and cooperating with the fixed partition to form an expansible chamber, there being an outlet port from said chamber through one of said end walls and means forming an inlet into said chamber through the other end wall and extended portion of said barrel.

2. In a fountain pen: means forming a circular barrel closed at its opposite ends; a rotatable element extending axially of said barrel; a pair of radial vanes extending longitudinally of said barrel between said element and the wall of the barrel, one of said vanes being fixed, the other vane being secured to rotate with said element, said vanes cooperating to form an expansible chamber; said element providing a passage opening into said chamber to establish communication therewith at one end, there being a port establishing communication at the other end.

3. In a fountain pen: means forming a circular barrel closed at its opposite ends; a rotatable tubular element extending axially of said barrel and projecting from one end thereof; a pair of radial vanes extending longitudinally of said barrel, between said element and the wall of the barrel, one of said vanes being fixed, the other vane being secured to rotate with said element, the vanes cooperating to form an expansible chamber; said element opening into said chamber to provide communication therewith, there being a port through one of said walls also adapted to provide communication with said chamber, said port being spaced radially from said element so as to be controlled by the rotatable vane.

4. In a fountain pen: means forming a circular barrel having transverse end closure walls; an element extending axially of said barrel and rotatably supported by said end walls; said element extending outwardly from one end of said barrel, a pair of radial vanes extending longitudinally of said barrel between said end walls and between said element and the wall of the barrel, one of said vanes being fixed, the other vane being secured to rotate with said element, said vanes cooperating to form an expansible chamber of maximum volume at one limit of movement of said other vane, and of minimum volume at the other limit of movement; there being a discharge port in one of said end walls so positioned as to communicate with said chamber only when said other vane is adjacent one of said limits of movement; and means extending through said element and forming an inlet into said chamber.

5. In a fountain pen: means forming a circular barrel having transverse end closure walls; a tubular element extending axially of said barrel and rotatably supported by said end walls; a pair of radial vanes extending longitudinally of said barrel between said end walls and between said element and the wall of the barrel, one of said vanes being fixed, the other vane being secured to rotate with said element, said vanes cooperating to form an expansible chamber; said tubular element extending through one of said end walls and having a port opening into said chamber adjacent the other end wall forming a passage establishing communication with said chamber, there being an opening through said other end wall forming a second passage for establishing communication with said chamber.

6. In a fountain pen: means forming a circular barrel having transverse end closure walls; a tubular element extending axially of said barrel and rotatably supported by said end walls; a pair of radial vanes extending longitudinally of said barrel between said end walls and between said element and the wall of the barrel, one of said vanes being fixed, the other vane being secured to rotate with said element, said vanes cooperating to form an expansible chamber; said tubular element extending through one of said end walls and opening into said chamber, forming a passage establishing communication with said chamber; a member secured to said element externally of said barrel and through which said element extends, said member being rotatably mounted on said barrel, as well as secured against axial movement with respect thereto; and a closure for the outer end of said element.

7. In a fountain pen: means forming a circular barrel closed at its opposite ends; means forming a penpoint at one end of said barrel; a pair of radial vanes extending longitudinally in said barrel, one of said vanes being fixed, the other vane being rotatable, said vanes cooperating to form an expansible ink receiving chamber in said barrel; means for operating said rotatable vane from the other end of the barrel; there being inlet and outlet ports in said chamber, the outlet port feeding ink to said pen point, the inlet port extending through said other end of the barrel.

8. In a fountain pen: means forming a circular barrel closed at its opposite ends; means forming a pen point at one end of said barrel; a pair of radial vanes extending longitudinally in said barrel, one of said vanes being fixed, the other vane being rotatable, said vanes cooperating to form an expansible ink receiving chamber in said barrel; means connected to said rotatable vane, projecting from the other end of said barrel; an extension rotatably mounted on said barrel for operating said means to rotate said vane; there being a pair of ports opening into said chamber, one of said ports being connected in fluid transfer relation with said pen point, the other port extending through said other end and said extension.

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