Aug. 22, 1950 C. A. BARSTOW 2,519,341

FOUNTAIN PEN

Filed Feb. 17, 1947

Fig. 1

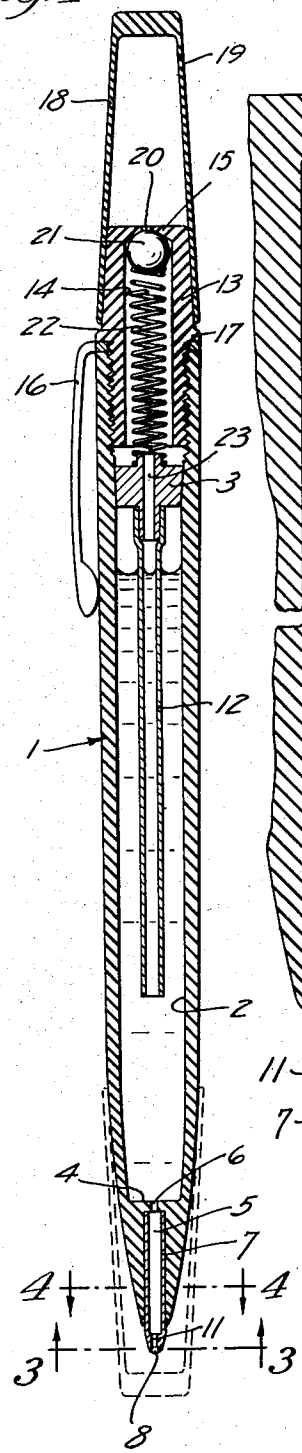


Fig. 2

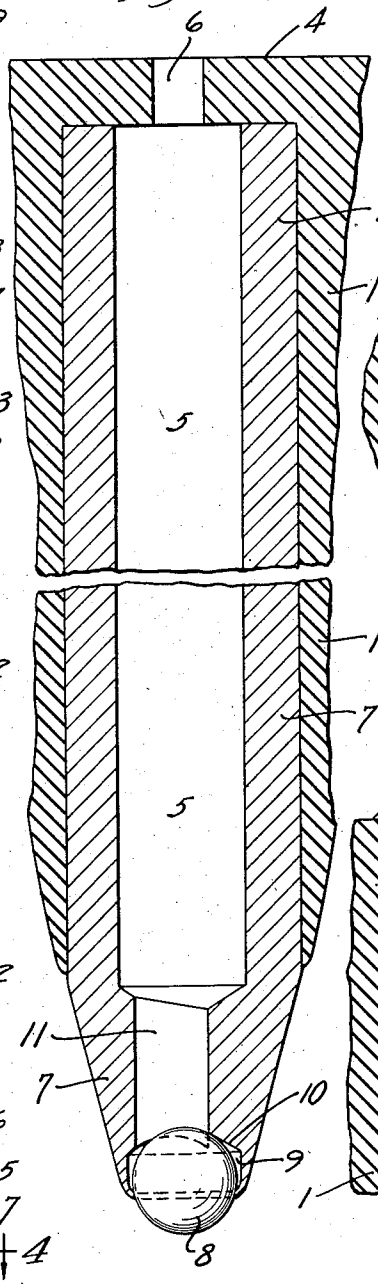


Fig. 3

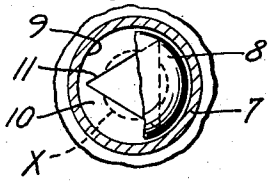


Fig. 4

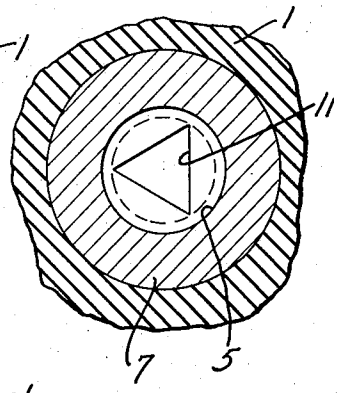
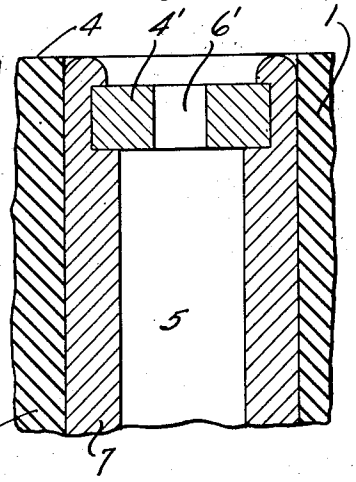


Fig. 5



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UNITED STATES PATENT OFFICE

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FOUNTAIN PEN

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Application February 17, 1947, Serial No. 729,147

4 Claims. (Cl. 120—42.4)

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My invention relates to improvements in fountain pens of the type employing a freely-rotating writing ball tip, and a reservoir supplying relatively very dense ink to the ball tip, and generally speaking is in the nature of an improvement on a fountain pen disclosed in my co-pending application, Serial No. 694,316, filed August 31, 1946, now abandoned.

An important object of the instant invention is the provision in a fountain pen of the type employing a freely-rotating writing ball tip, and a reservoir feeding dense ink to the tip, of an improved means for admitting air to the reservoir to replace ink withdrawn therefrom by the writing ball tip without allowing ink to be discharged to atmosphere, through air intake means, in any angular position of the pen or as a result of thermal expansion or contraction of the pen body or ink.

Another important object of the invention is the provision, in a pen of the class described, of an improved construction intermediate the writing ball tip and the reservoir, whereby dense ink of the kind now generally embodied in pens of this character will be continuously supplied to the writing surface of the ball under all writing conditions and irrespective of the amount of pressure applied to the ball or the speed with which it is moved over the work surface.

The above and other highly important advantages of the instant invention will be made apparent from the following specification, claims and appended drawings.

Referring to the drawings:

Fig. 1 is an axial sectional view on an enlarged scale of a fountain pen embodying the invention;

Fig. 2 is a greatly enlarged fragmentary view of the writing tip equipped front end portion of the pen of Fig. 1;

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1, but enlarged to the scale of Fig. 2;

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 1, but enlarged to the scale of Fig. 2; and

Fig. 5 is a fragmentary axial sectional view similar to the upper portion of Fig. 2 and illustrating a somewhat modified construction.

Referring with greater particularity to the drawings wherein a preferred embodiment of the invention is illustrated, the numeral 1 indicates an elongated tubular body commonly referred to in the art as a barrel. This tubular body or barrel 1 has a large diameter bore 2 opening through the rear end thereof and providing a large capacity

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primary reservoir for dense ink; the term "dense ink" being used herein to designate the relatively-thick slow-flowing type of ink commonly used in ball tip pens at this time, and which may be said to have more or less the consistency of printer's ink as distinguished from the very thin free-flowing inks common to other types of writing instruments. The rear or upper end of the primary reservoir-acting bore 2 of the barrel 1 is largely closed by a plug 3 which may be assumed to be press fit therein, and the front or lower end portion of the primary reservoir 2 of the barrel 1 is largely closed by a wall 4. The large capacity primary reservoir 2 feeds forwardly into a much smaller capacity secondary reservoir 5 through a highly restricted orifice 6 in the wall 4. In the preferred embodiment of the invention illustrated, the secondary reservoir 5 is formed within a tubular element 7 mounted in and projecting through and slightly beyond the tapered front end of the barrel-like body 1, and providing also a mounting for the writing ball tip 8. In a broad sense, this tubular element 7 comprises part of the barrel-like body 1.

The writing ball 8 is contained within a cavity 9 formed in the tapered front end of the tubular element 7 and which has a conical upper or rear wall surface 10 against which the writing ball 8 makes arcuate line sealing contact, as indicated by broken circle X of Fig. 3. The circular side wall of the ball-receiving cavity 9 is spaced from the ball to a plane forwardly of the maximum diameter of the ball where it diverges toward and terminates in close-working clearance with the ball. The circular free end of the element 7 thus cooperates with the conical upper wall surface of the cavity 9 to maintain the writing ball 8 centered in the cavity 9, and the annular space within the cavity 9 radially outwardly of the ball 8 provides an ink-distributing chamber.

In accordance with the invention hereof, the annular ink-distributing chamber surrounding the ball 8 is supplied with dense ink from the secondary reservoir 5 through an axially-centered metering passage 11 that is cross-sectionally polygonal. Preferably, and in accordance with the preferred embodiment of the invention shown, this polygonal passage 11 is defined exclusively by cross-sectionally flat wall surfaces circumscribing a circle of less diameter than the annular line ball seat, indicated by X in Fig. 3; but circumscribed by a circle of larger diameter than the said circular ball seating line, indicated by X in Fig. 3. In the preferred embodiment illustrated, this straight-sided polygonal passage 11 is trian-

gular or three-sided. Hence, in the preferred embodiment of the invention illustrated, the three corners of the triangular passage cut through the circular ball-seating line X (see Fig. 3) of the conical inner or rear wall surface 10 of the ball tip receiving cavity 9 at three points, thereby dividing the line of arcuate contact between the ball and conical surface 10 into three circumferentially-spaced segments between which ink is free to flow, in an axial direction, into the annular distributing chamber surrounding the ball point 9. Thus a continuous supply of ink from the secondary reservoir is assured regardless of the amount of pressure applied between the ball and segmental seating lines, or the length of writing strokes. The element 7 is preferably formed of brass or similar metal, and the metering passage 11 is preferably formed by a simple broaching operation. In accordance with this very simple procedure and construction, one of the major causes for intermittent starving of the writing ball of ink is obviated.

In ball point pens of the type employing dense ink supplied directly from a relatively-large diameter ink reservoir through a restricted passage, intermittent starving of the ball tip is common due to the inherent tendency of such dense ink to flow intermittently through the restricted delivery passage. Peculiarly, however, this intermittent feeding action seems to be entirely overcome when the ink is fed to the ball from a relatively very small diameter reservoir, for example, a reservoir having a diameter in the neighborhood of $\frac{3}{32}$ of an inch. Hence, in accordance with the present invention, I provide the small diameter secondary reservoir 5 intermediate the main reservoir 2 and the ball tip, and which secondary reservoir 5, although receiving ink intermittently from the primary reservoir 2, will continuously supply ink to the writing ball 8.

The plug 3 is spaced from the rear end of the barrel-like body 1 and carries a depending or forwardly-projecting air tube 12, the free end of which is in open communication with the reservoir and located, preferably, beyond the longitudinal center of the primary reservoir 2. An elongated tubular plug 13 is screw-threaded into the rear end of the barrel 1 and has a longitudinal bore providing an air chamber 14 located rearwardly of the plug 3, and which chamber is largely closed at its rear end by a wall 15. In the preferred arrangement illustrated, a pocket clip 16 is clamped between the rear end of the barrel-like body 1 and an annular flange 17 of the screw-threaded plug 13, and said plug is rearwardly tapered to receive a point covering cap 18 when the latter is removed from its operative position, shown by dotted lines in Fig. 1. For reasons which will hereinafter be apparent, the cap 18 is preferably provided with an air vent 19. The end wall 15 of the plug 13 is provided with an air passage 20 from the air chamber 14 to atmosphere, and this air passage 20 is controlled by an outwardly-closing check valve 21 seated against the conical end of the chamber 14 by a coil compression spring 22 interposed between the ball 21 and the plug 13. The inner end of the air tube 12 is in communication with the air chamber 14 through a passage 23 in the plug 3.

In the pen illustrated, primary and secondary reservoirs will be filled with ink to the desired level before the plug 3 is applied, and no means is illustrated for convenient refilling of the ink reservoirs. In many cases this will be satisfactory due to the great ink capacity of the pen, but, of course, the barrel 1 may be provided with any desired means for convenient filling of the primary reservoir when such is desirable. The reservoir should not, however, be filled with ink to over approximately three-quarters of its depth prior to insertion of the plug 3 and air tube 12, since it is desirable to maintain the ink level in the reservoir materially spaced from the air chamber 14.

The air tube 12 is common to my previously-filed copending application, Serial No. 694,316, filed August 31, 1946, but in the construction illustrated in said application, the rear end of the air tube is vented directly to atmosphere; whereas, in accordance with the present invention, this air tube 12 opens into the air chamber 14 which communicates with atmosphere only through the passage 20, which is controlled by the outwardly-closing check valve, which permits air to be drawn into the air chamber 20, but prevents air from being exhausted to atmosphere from the chamber 20. As in the structure of my said earlier co-pending application, the bore of the air tube 12 is large enough to prevent outward flow of ink therethrough by capillarity and is small enough in diameter to maintain the relatively dense ink therein at equilibrium due to surface adhesion so as to prevent outward flow therethrough under the action of gravity when the pen is disposed horizontally or inverted. However, thermal expansion and contraction of the body 1 and ink is another phenomenon tending at times to force ink outwardly through the air tube, and is a factor not taken into consideration or dealt with in the pen disclosed in my above-identified co-pending application. Of course, pressures built up within the primary reservoir 2 due to thermal expansion are very slight, and even when the air tube 12 is vented directly to atmosphere, as in accordance with the teachings of my said previous co-pending application, is never sufficient to cause more than a slight bubble to form at the atmosphere end of the venting passage; but it will be appreciated that even minute quantities of ink at the rear end of the pen are objectionable. This difficulty, however, is entirely eliminated in the pen of the present application due to the fact that the pressure within the air chamber 14 will at all times equal the pressure within the primary reservoir 2. In other words, any rise in pressure within the reservoir 2 will tend to produce an equal back pressure in the air chamber 14 and which will be sufficient to prevent any flow whatsoever into the chamber 14. It will be appreciated, however, that the ball check valve 21 will open to admit air to the chamber 14, and from the chamber 14 through the air tube to the primary reservoir 2 to replace ink dispensed by the writing ball.

In Fig. 5 I show a slightly-modified arrangement wherein the wall between the bore 5 of the tubular element 7 is closed at its upper end by a clinched-in closure disc 4' having therein a restricted passage 6' which corresponds to the restricted passage 6 of Figs. 1 and 2. This arrangement may offer some advantage in manufacture since it only requires a straight-through constant diameter bore to receive the tubular element 7 extending from the front end of the body 1 to the primary reservoir 2.

It will, of course, be understood that various modifications will be made without departing

from the spirit of the invention or the scope of the appended claims.

What I claim is:

1. In a fountain pen, a tubular body providing an ink reservoir and having an outwardly-opening writing ball-receiving cavity at its front end, said cavity having a rear wall surface and a circular side wall surface, and a writing ball contained within said cavity and making arcuate line sealing contact with the rear wall surface of the cavity, all portions of said arcuate line-sealing contact describing segments of a common arcuate line contact circle, the circular side wall surface of the body defining the ball-receiving cavity being radially spaced from the writing ball from the rear wall surface thereof to a plane outwardly of the maximum diameter of the ball, and being contracted and brought into working clearance with the ball beyond the maximum diameter of the ball, said body having a central passage extending from the ink reservoir through the rear wall surface of the writing ball cavity, said passage being polygonal in cross-section and being of a size and shape to circumscribe a circle of less diameter than that of the circle of arcuate line contact between the writing ball and the rear wall surface of the cavity and being of a size and shape to be circumscribed by a circle of greater diameter than that of the circle of arcuate line contact between the ball and the rear wall surface of the cavity, whereby said polygonal passage cuts through the circle of arcuate line contact between the ball and seat to permit straight-through flow of ink to the space within the ball cavity surrounding the ball.

2. The structure defined in claim 1 in which the walls defining said polygonal passage are all cross-sectionally straight.

3. The structure defined in claim 1 in which said polygonal passage is triangular in cross section.

4. The structure defined in claim 1 in which said polygonal passage is triangular in cross section and is of constant diameter from end to end.

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