May 21, 1946. D. F. MOHNS 2,400,768

FOUNTAIN PEN

Filed Oct. 12, 1944

Fig. 1.

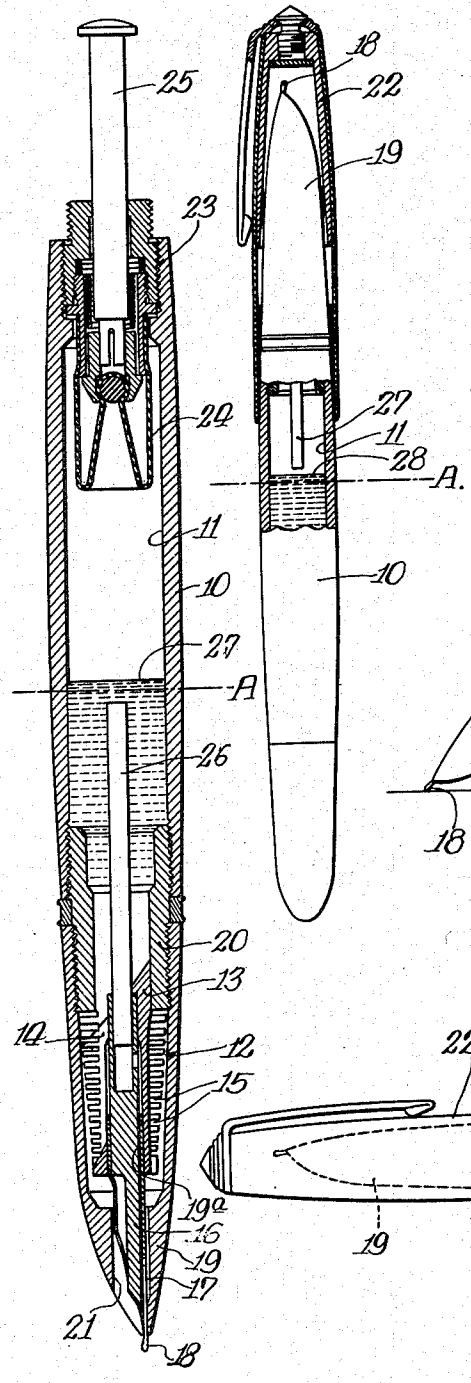


Fig. 2.

Fig. 3.

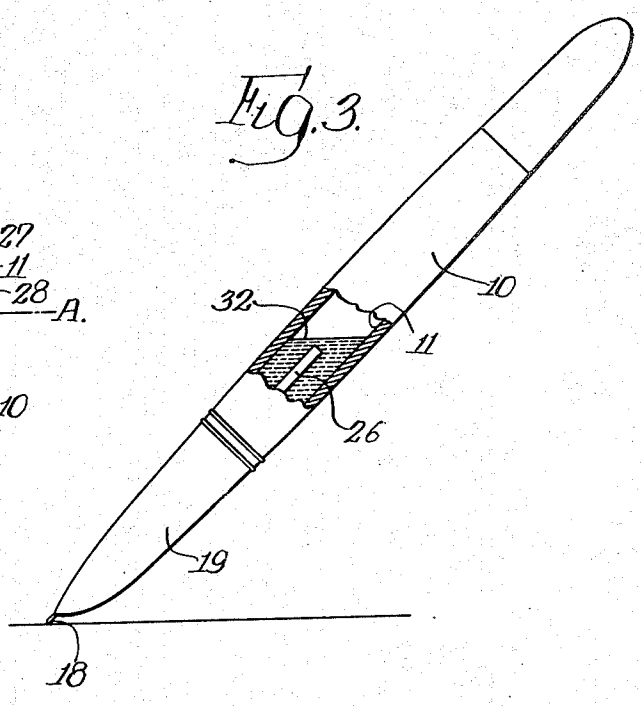
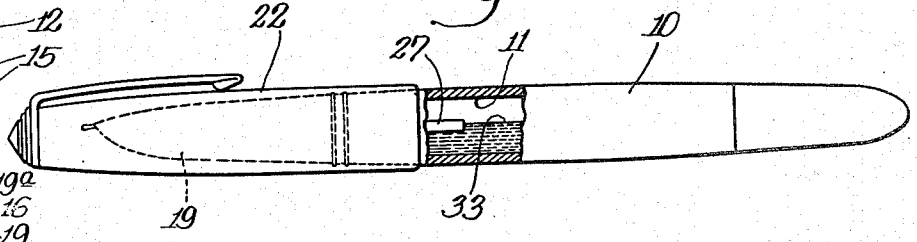


Fig. 4.



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FOUNTAIN PEN

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9 Claims. (Cl. 120—47)

My invention relates generally to fountain pens and has to do particularly with a fountain pen provided with a multiple-stroke filling device of the type including a breather tube extending from the feed structure of the pen into the ink reservoir thereof.

The principal object of my invention is to provide an improved fountain pen of the foregoing character.

Another object is to provide a fountain pen having provision for preventing leaking and flooding, and particularly a fountain pen well suited for use in airplane travel.

A further object is to provide a fountain pen of the foregoing character having provision for automatically preventing such change in the normal pressure relationship existing between the air within and outside of the reservoir, when a reduction of atmospheric pressure occurs, as would cause flooding or leaking of the pen.

Still another object is to provide a fountain pen of the foregoing character wherein the length of the breather tube is such relative to the volumetric capacity of the ink reservoir that proper pressure conditions within the reservoir to prevent leaking or flooding are maintained.

A still further object is to provide a fountain pen of the foregoing character wherein the breather tube is so located in the reservoir as to provide for automatic re-establishment of the normal pressure relationship existing between the air within and outside of the reservoir, upon reduction of atmospheric pressure.

A more specific object is to provide a fountain pen of the foregoing character wherein the breather tube has a free and open end projecting into the ink reservoir and terminating intermediate the ends of the reservoir short of the volumetric mid-plane thereof so that the end of the breather tube will be open to the air in the reservoir in at least horizontal and point-up positions of the pen.

A further object is to provide a fountain pen of the foregoing character which is so constructed and arranged that the amount of ink that may be discharged from the ink reservoir under the most extreme operating conditions does not exceed that amount which the feed mechanism is capable of retaining without leaking and flooding.

Other objects and advantages will become apparent as the following description progresses and by reference to the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view on an enlarged scale, showing a fountain pen embodying the features of the invention, with the pen in a vertical or filling position.

Fig. 2 is a view showing the pen with its point end up as when carried in the pocket.

Fig. 3 is a view showing the pen in writing position.

Fig. 4 shows the pen in horizontal position as when lying on a desk or in a handbag.

The fountain pen which I have chosen to illustrate my invention comprises a barrel 10, the interior of which constitutes an ink reservoir. It is to be understood that while my invention has particular utility in a pen of the type illustrated, it also is well adapted for use in a pen embodying an ordinary ink sac as the ink reservoir.

In the pen illustrated, ink feeding means, indicated generally at 12 (Fig. 1) is mounted in the front end of the barrel in communication with the ink reservoir 11. In the broader aspects of the invention any suitable feed structure capable of use with a multiple stroke filling device may be employed. However, the particular feed structure shown herein, and in connection with which my invention has special utility, is of the type disclosed in United States Letters Patent No. 2,223,541 granted to Marlin S. Baker on December 3, 1940. Other forms of feed structure that may be used are illustrated in United States Letters Patent Nos. 1,980,508 granted to Ivan D. Tefft on November 13, 1934, and 1,904,358 granted to Arthur O. Dahlberg on April 18, 1933.

The feed structure illustrated (Fig. 1) includes an ink governor or collector device 13 mounted in the front end of the barrel 10 in communication with the ink reservoir 11. This governor is provided with a capillary ink feed passage 14 intersecting a plurality of annular capillary cells 15 adapted to receive and store ink that may tend to flow from the reservoir 11 through the feed passage in excess of that required for writing purposes. The governor 13 receives and supports a feed bar 16 and a tubular pen point 17, these parts being arranged to provide capillary passages 19 connecting with the feed passage 14 and the writing tip 18 of the pen nib 17, as more fully described in said Baker Patent No. 2,223,541. The governor 13, feed bar 16 and pen nib 17, except the writing tip 18 of the latter, are enclosed within a shell 19 secured to the forward end of the pen barrel by a bushing member 20.

In the use of the feed structure just described, air is permitted to flow to the reservoir 11 through an opening 21 in the forward end of the shell 19 and thence through the rearmost capillary governor cell or cells 15, when they are free of

ink, to bubble back to the ink reservoir through the rear end of the ink passage 14. The admission of air to the reservoir in the normal writing operation is necessary in order that ink may be withdrawn from the reservoir for writing purposes; but when, after a condition of flooding or leaking and the capillary governor cells 15 have ink therein, air cannot pass therethrough to the ink reservoir so that feeding of further ink from the reservoir is discontinued and ink is taken only from the governor structure in further writing until the governor cells are again clear.

A cap 22 is adapted to be detachably fitted to the front end of the pen for protecting the writing point thereof when the pen is not in use, which cap, if desired, is adapted to be fitted upon the rear of the barrel when the pen is in use.

Referring to Fig. 1, a filling device, indicated generally at 23, of the multiple stroke type, such as shown in said Dahlberg Patent No. 1,904,358, is secured at the rear end of the barrel 10. This filling device includes a flexible diaphragm 24 actuated by a reciprocable plunger 25 to vary the effective volume of the reservoir 11 to cause ink to be drawn thereinto in the manner fully explained in said Dahlberg patent. That is to say, on each complete stroke of the filling plunger 25 a small quantity of ink is drawn into the reservoir so that the reservoir may be filled to a predetermined extent upon the completion of a plurality of strokes.

The filling device 23 further includes a so-called breather tube 26 which has one end supported within an opening in the rear end of the feed bar 16 in communication with the capillary ink passage 14 and its other end extending rearwardly within and in communication with the ink reservoir. As taught by the Dahlberg patent, air is expelled through the breather tube 26 in the operation of the filling plunger 25 and the relative displacement of air and ink upon actuation of the plunger 25 is such as to cause the filling of the pen as above mentioned.

It will be appreciated that in the use of a filling device of the type illustrated in Fig. 1, the filling of the reservoir may be continued by multiple stroke action until the level of the ink in the reservoir reaches the open end of the breather tube. Should the filling operation be continued after this, ink may be drawn into the reservoir in an amount equal to that which is drawn into the reservoir during one filling stroke, thereby raising the level of the ink in the reservoir to that extent above the open end of the breather tube. If the filling operation is continued after the latter condition exists, ink instead of air will be forced out by the filling device, upon depression of the filling plunger 25, so that regardless of additional filling strokes, substantially the same amount of ink will be forced out as is drawn in, no air being forced out because, under the condition stated, the end of the tube is covered with ink, and air cannot be forced out until the ink level is reduced to uncover the end of the tube. Therefore, it will be seen that the extent to which the reservoir may be filled, i. e., the maximum ink level in the reservoir—is determinable by the length of the breather tube 26.

The type of pen disclosed in the drawing is well known in the trade as the "51" pen manufactured and sold by The Parker Pen Company of Janesville, Wisconsin. In filling this pen it is desirable that the filling operation be carried out in such a way that the governor 13 is substantially cleared of ink upon the completion thereof. To this end, in the last filling stroke, the front end of the pen may be lifted from the ink supply from which it is being filled and the filling plunger 25 released after such removal so that in the very last suction stroke there is drawn into the ink reservoir ink in an amount not exceeding the capacity of the governor 13. Therefore, it will be obvious that in the pen of the particular type shown, the ink level will not be extended beyond the end of the breather tube 26 to an extent in excess of the volume of ink that may be stored in the governor 13.

In pens of the type shown in said Tefft and Dahlberg patents, Nos. 1,980,508 and 1,904,358, respectively, the last filling stroke may be completed with the front end of the pen immersed in the body of ink from which the pen is being filled. In that case, upon complete filling, the amount of ink in the reservoir beyond the open end of the breather tube will not exceed the volume of ink drawn into the reservoir on one normal filling stroke of the pen.

In prior pens embodying the foregoing type of filling mechanism, the breather tube has always been of such length as to extend in close proximity to the rear end of the ink reservoir so as to enable the filling of the reservoir substantially completely. This has presented a serious difficulty from the standpoint of leaking and flooding in airplane travel. For example, with the foregoing prior breather tube arrangement, when the pen point is in an inverted or upright position, as when carried in one's pocket, the open end of the breather tube is completely submerged in the ink in the reservoir and, during air travel, in the ascent of the plane the reduction in the outside air may become such that the pressure of the air in the reservoir acting on the ink will cause ink to be discharged from the reservoir through the breather tube and the capillary passages connected therewith. In this case, the open end of the breather tube remains submerged until the reservoir is almost empty, and the amount of ink discharged may be in excess of the capacity of the feed mechanism to absorb the same so that excess ink leaks or floods at the writing tip of the pen into the closure cap (corresponding to the closure cap 22) which will then be in place on the front end of the pin. If this condition exists removal of the cap 22 for use of the pen in the airplane will result in smearing of ink upon one's hands and clothing.

My invention completely avoids the foregoing objectionable condition and provides a pen in which changes of pressure within the reservoir relative to the outside atmosphere will not cause ink to be forced from the pen to cause leaking or flooding at the writing tip 18 thereof in any position of the pen. To the foregoing end the breather tube 26 is positioned concentrically in the reservoir 11 and is of such length relative to the volumetric capacity of the reservoir 11 that its open end is at all times open to the air space in the reservoir in the inverted or point-up position of the pen.

Specifically, I attain the foregoing result by positioning the inner or open end of the breather tube 26 at such a point between the opposite ends of the reservoir that the maximum level of the ink that can be drawn into the reservoir on one stroke of the filling device, as indicated at 27 (Fig. 1) is below such open tube end, as indicated at 28 in Fig. 2 when the pen is in point-up or inverted position. More particularly, the reservoir 11 is of such length and diameter that,

after the feed and filling mechanisms are assembled as shown, the volumetric mid-plane thereof (a plane perpendicular to the longitudinal axis of the reservoir and dividing the volumetric capacity of the reservoir into two equal parts) is located on the line A (Figs. 1 and 2), and the inner end of the breather tube 26 terminates short or forwardly of the volumetric mid-plane by a distance greater than one-half the longitudinal dimension in the reservoir of the volume of ink that can be taken in on one suction stroke of the filling device. In this arrangement, the volume of the reservoir 11 forwardly of the inner end of the breather tube 26 is less than the volume rearwardly thereof.

When the pen is in its point-up position (Fig. 2), the open end of the breather tube 26 will always lie in the air space in the reservoir so that if there is any tendency to disturb the normal pressure relationship between the air within and outside of the reservoir, as in airplane travel, which would otherwise cause a discharge of ink from the reservoir, such pressure relationship will be automatically reestablished through the breather tube, preventing discharge of ink from the reservoir.

When using a completely filled pen in writing position, the ink will assume a level such as indicated at 32 in Fig. 3. In this case the volume of the ink above the open end of the breather tube is no greater than the capacity of the governor 13. Therefore, if in this case, the normal pressure relationship is disturbed sufficiently to cause discharge of ink from the reservoir 11, the amount of ink discharged would not exceed the capacity of the governor 13 and it would be taken up therein without flooding or leaking at the writing point of the pen.

In the horizontal position of the pen, as shown in Fig. 4, the ink will assume a level, indicated at 33, which is only slightly above the axis of the breather tube 26 because the latter is concentric with the reservoir. Thus, the inner end of the breather tube 26 will be located at least partially within the air space in the reservoir. Since air will pass through the breather tube and feed structure more easily than ink, a disturbance of the normal pressure relationship will cause air, rather than ink, to be discharged from the reservoir. While tilting the pen so that the point is down will tend to shift the ink level above the end of the breather tube, the ink above the end of the breather tube will be forced from the reservoir into the cells 20, as when the pen is in writing position, and no leaking or flooding will occur.

Thus, in a pen construction in accordance with my invention, the rear end of the breather tube will be within the air space in the reservoir for normal carrying positions of the pen, and consequently upon disturbance of the normal pressure relationship, air alone will be forced out of the reservoir through the feed structure. Should the pen be completely filled and used for writing under such conditions, or carried with the point end down, only so much ink as can be stored in the cells 20 will be discharged from the barrel. Thus in no case will the pen be caused to leak or flood at the writing tip. The pen may therefore be safely carried and used during airplane travel.

The foregoing description takes a completely filled pen into consideration, which is the maximum condition that can be imposed. However, it will be appreciated that in many conditions of use (which will be the case in the majority of instances) the level of the ink in the reservoir will be below the open end of the breather tube 26 in the writing position of the pen, and the proper pressure condition may be established through the breather tube without ink being discharged into the governor or feed means.

I claim:

1. A fountain pen comprising a reservoir, a feed structure, and a multiple stroke filling device including a breather tube extending from said feed structure into said reservoir, the inner end of said breather tube being short of the volumetric midplane of said reservoir by a distance greater than one half the longitudinal dimension in the reservoir of the ink that can be taken in by one suction stroke of the filling device whereby the level of the ink will be below the end of the breather tube when the pen is positioned with the point end up.

2. A fountain pen comprising a reservoir, a feed structure secured to the front end of the reservoir, and a multiple stroke filling device mounted in the rear end of the reservoir and including a breather tube extending from said feed structure into said reservoir, the rear end of said breather tube being spaced forwardly of the volumetric midplane of said reservoir by a distance greater than one half the longitudinal dimension in the reservoir of the volume of ink that can be taken in on one suction stroke of the filling device, whereby the level of the ink will be below the end of the breather tube when the pen is positioned with the front end up.

3. A fountain pen having an ink reservoir, an ink feed connected with said reservoir, and filling mechanism for said reservoir comprising a displacement element, and an air discharge element projecting from said ink feed into the reservoir only to a point where the ink drawn in on the last suction stroke of the displacement element will fill the reservoir to a level spaced above the volumetric midplane of the reservoir a distance less than one half the longitudinal dimension in the reservoir of the ink that can be taken in by one suction stroke of the displacement element whereby said air discharge element extends into the air space in the reservoir when the pen is positioned with its front end up.

4. A fountain pen comprising a reservoir, ink feed means in the front end of the pen, filling means in the rear end of the pen, and air discharge means in said ink feed means, said filling means including a tubular element constantly in communication with said air discharge means and opening into the reservoir at a point between said ink feed means and filling means and determining the level to which said filling means can fill said reservoir, said point being so located that the volume of the reservoir forwardly of said point is less than the volume of said reservoir rearwardly of said level, whereby said element opens into the air space in the reservoir when the front end is up.

5. A fountain pen comprising a barrel providing a reservoir, a feed structure secured to the front end of the barrel, and a multiple-stroke filling device mounted in the rear end of the barrel and including a breather tube extending rearwardly in and concentrically with said reservoir from said feed structure, the inner end of said breather tube being spaced forwardly from the volumetric midplane of said reservoir by a distance greater than one-half the longitudinal dimension of the volume of ink that can be drawn into the reservoir by one suction stroke of the filling device.

6. A fountain pen comprising a reservoir, a feed structure having an ink passage and means for storing excess ink in communication with said reservoir, and a multiple-stroke filling device including a breather tube extending from said feed structure into said reservoir with its inner end short of the volumetric midplane of the reservoir a distance greater than one-half the longitudinal dimension in the reservoir of the ink that can be taken in by one suction stroke of the filling device whereby flooding or leaking of the pen is prevented when the normal pressure relationship between air within and outside of the reservoir is disturbed for any position of the pen.

7. A fountain pen comprising a reservoir, a feed structure having an ink passage from said reservoir and means for storing excess ink opening directly into said ink passage, and a multiple-stroke filling device including a breather tube extending from said feed structure into said reservoir to a point where the volume of said reservoir forwardly of said point is less than the volume rearwardly therefrom by an amount greater than the volume of ink that can be taken in on one suction stroke of the filling device, whereby leaking or flooding of the pen is prevented when the normal pressure relationship between the air within and outside of the reservoir is disturbed for any position of the pen.

8. A fountain pen comprising a reservoir, a feed structure having an ink passage and means for storing excess ink in direct communication with said reservoir, and a multiple-stroke filling device including a breather tube extending from said feed structure into said reservoir with its inner end spaced from the volumetric midplane of the reservoir a distance greater than one-half the longitudinal dimension in the reservoir of the ink that can be taken in by one suction stroke of the filling device, the ink in said excess ink storage means being withdrawn therefrom into the reservoir at the conclusion of the filling operation whereby any ink discharged from the reservoir by a disturbance of the normal pressure relationship between the air within and outside of the reservoir, when the point end is down, will be taken up by said excess ink storage means.

9. A fountain pen comprising a reservoir, a feed structure at the front end of the pen having an ink passage from said reservoir and capillary ink storage cells opening into said ink passage, and a multiple-stroke filling device at the rear end of the pen including a breather tube extending rearwardly from said feed structure into said reservoir and determining the level to which said filling device can fill said reservoir, the inner end of said breather tube being so located that the volume of the reservoir forwardly of said inner end is less than the volume of said reservoir rearwardly of said level whereby the breather tube opens into the air space in the reservoir when the front end of the pen is up, the ink entering said cells during filling being withdrawn into the reservoir by a suction stroke of the filling device at the conclusion of the filling operation whereby the maximum quantity of ink from the reservoir that will be discharged therefrom by a disturbance of the normal pressure relationship between the air within and outside of the reservoir when the point end is down will be equal to the capacity of said cells and will be taken up thereby.

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