

April 18, 1933.

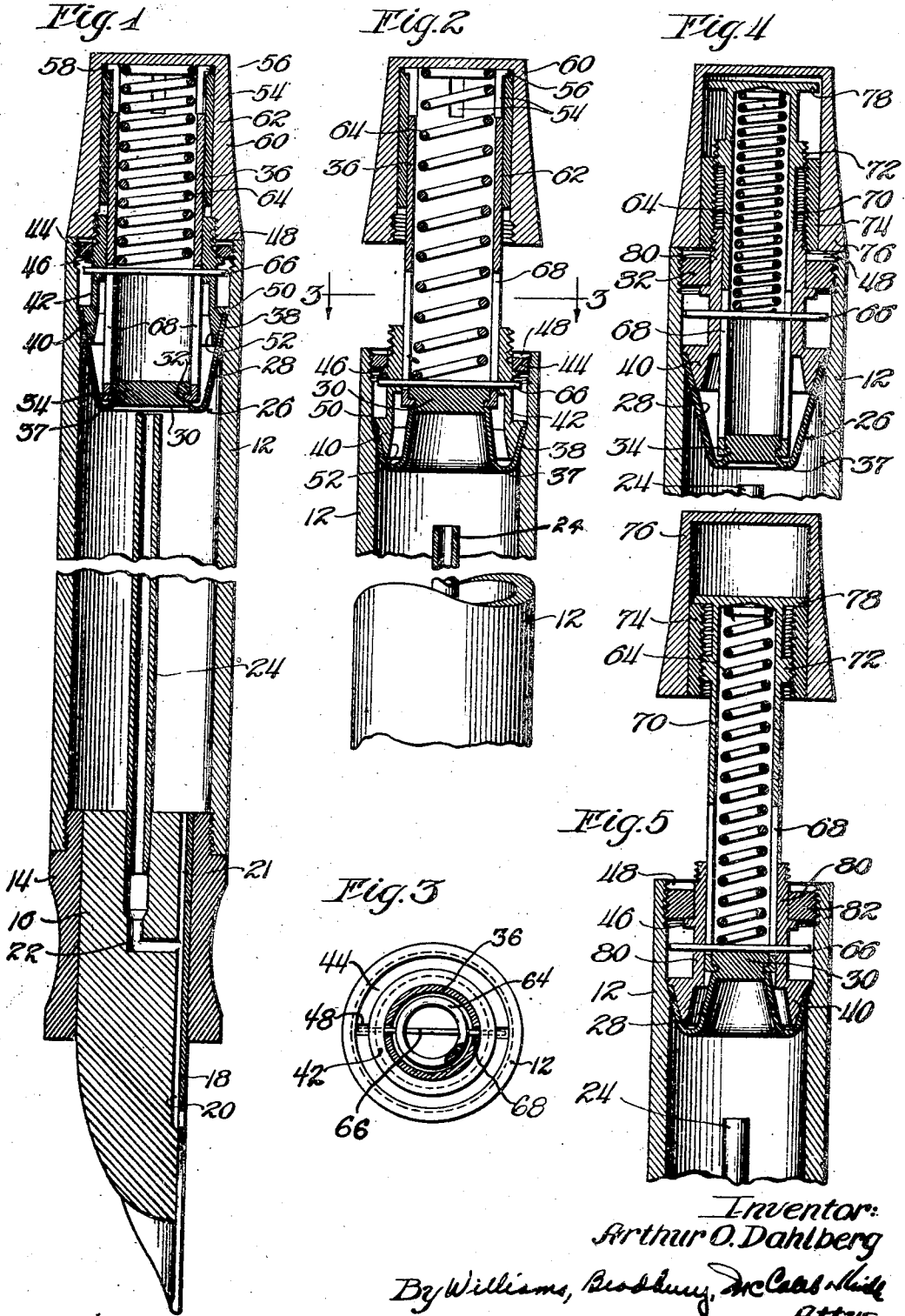
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1,904,358

FOUNTAIN PEN

Original Filed Sept. 14, 1928

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 9

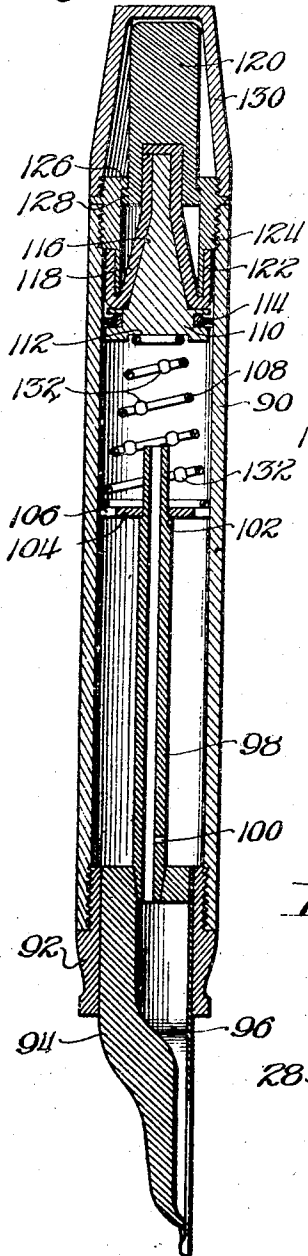


Fig. 10

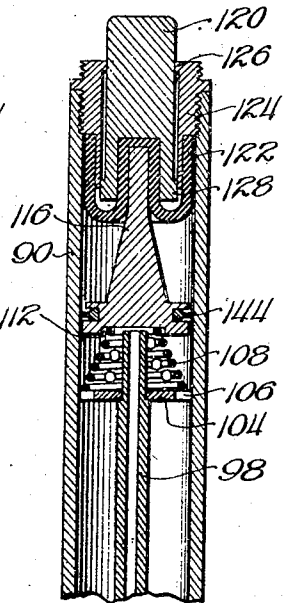


Fig. 7

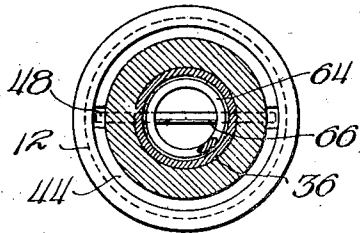


Fig. 6

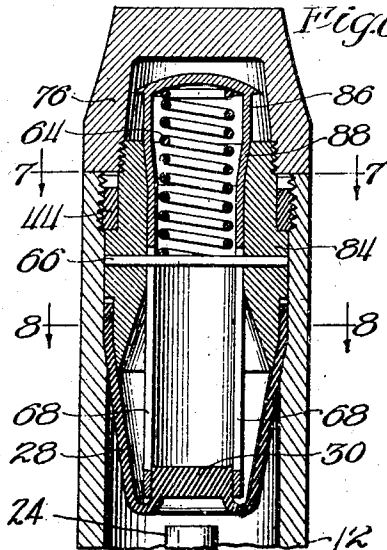


Fig. 8

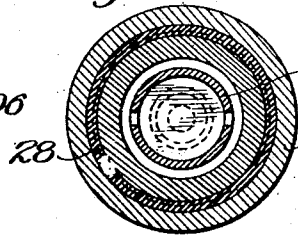
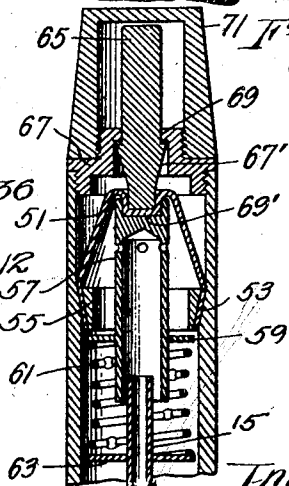


Fig. 11



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UNITED STATES PATENT OFFICE

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FOUNTAIN PEN

Continuation of application Serial No. 308,009, filed September 14, 1928. This application filed January 24, 1933. Serial No. 653,346.

My invention relates generally to fountain pens and more particularly to filling means therefor.

The principal objects of my invention are to provide:

First: An improved filling device which may be easily operated with one hand;

Second: A flexible diaphragm to seal one end of the barrel, thereby to eliminate the possibility of ink leakage;

Third: A filling device in which most of the parts may be made of metal and are kept from contact with the ink;

Fourth: A cap for the end of the barrel, the cap being rotatably secured to the plunger of the filling device;

Fifth: A cap which is automatically raised on the plunger as the cap is unscrewed from the barrel;

Sixth: A filling device which may be removed from the barrel as a unit;

Seventh: A filling device, the parts of which may be easily manufactured and assembled;

Eighth: A filling device which takes up only a relatively small portion of the interior of the barrel, thus permitting the utilization of a greater volume of the barrel as an ink reservoir;

Ninth: A filling device in which the diaphragm is wedged in place, thus insuring tightness without the use of cement or adhesive;

Tenth: A filling device in which the force of a spring is utilized on the suction stroke; and

Eleventh: A filling device which is durable, may be economically manufactured, and may be easily and quickly operated.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which:

Fig. 1 is a central longitudinal section of a fountain pen in which a preferred form of the filling device of my invention is incorporated, showing the parts in normal inoperative position;

Fig. 2 is a similar view of the filling device only, showing the parts in normal operating position;

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a central longitudinal section of a modified form of filling device, with the parts in normal inoperative position;

Fig. 5 is a similar view showing the parts in normal operating position;

Fig. 6 is a central longitudinal section of a second modified form of filling device;

Figs. 7 and 8 are transverse sectional views thereof taken on lines 7—7 and 8—8, respectively, of Fig. 6;

Fig. 9 is a central longitudinal section of a fountain pen in which a third modified form of filling device is incorporated, the parts being in normal inoperative position;

Fig. 10 is a similar view of the filling device shown in Fig. 9 with the parts thereof shown in operated position; and

Fig. 11 is a central vertical sectional view of a fountain pen with a fourth modified form of filling device, showing the parts in normal position.

The pen as shown in Figs. 1, 2 and 3 comprises a barrel 12, the lower end of which is threaded to receive the usual section 14, into which a feed bar 16 and pen point 18 are secured in the customary manner.

The feed bar has a longitudinal ink feeding groove 20, 21 and an elbow shaped air duct 22 formed therein, the air duct joining the ink groove at a point between the portions 20 and 21 of the latter. An air tube 24 is pressed into the upper end of the duct 22 and extends upwardly into the barrel to within a short distance of the upper end thereof. The feed bar and air tube are of the type exemplified in the patent to Taylor No. 802,668, dated October 24, 1905, and are well known in the art.

The upper end of the barrel 12 is closed by a pliable sealing member or flexible diaphragm 26 made of rubber or other suitable material. The diaphragm has a frusto-conical portion 28 and a central portion 30 which is preferably made thicker than the portion 28 and has a shallow annular groove 32 formed therein to receive an inwardly extending annular flange 34 of a tubular plunger 36. The portion 28 of the diaphragm is joined

to the central portion 30 by an annular trough shaped portion 37 which forms an initial bend in the diaphragm to aid in causing the diaphragm to roll freely upon itself as will more fully appear hereinafter.

The outer edge portion of the diaphragm is pressed or clamped against a tapering annular shoulder 38 formed in the barrel 12 by the complementally tapered ring portion 40 of a sleeve 42.

The sleeve 42 is forced into the barrel by an annular nut 44 which is threaded in the end of the barrel and engages a shoulder 46 on the sleeve 42. The nut 44 has kerfs 48 to receive a spanner wrench. The nut is preferably screwed into the barrel a sufficient distance so as to be slightly beneath the end of the barrel. The sleeve 42 has an annular shoulder 50 at the upper end of the tapered portion 40 which is of substantially the same diameter as the inside of the barrel and thus prevents the portion 28 of the diaphragm from sliding upwardly on the wedge portion 40 when the diaphragm and sleeve are being inserted into the barrel.

The wedge portion 40 has a tapered bore 52 to provide clearance for the diaphragm when it is at the upper end of its stroke.

The plunger 36 has a plurality of narrow open end slots 54 cut in its upper end, the tongue portions between the slots having small outwardly extending beads or flanges 56 formed thereon. These flanges project into an annular groove 58 undercut in a cap 60, or, as shown, formed at the end of a bushing 62 which is pressed into the cap. The lower end of the cap 60 is internally threaded and adapted to be screwed upon the end of the sleeve 42.

A compression coil spring 64 is confined between the end wall of the cap 60 and a pin 66 which passes through longitudinal slots 68 formed in the plunger 36 and the ends of which rest in suitable holes drilled in the sleeve 42. The pin is sufficiently long so that it is confined against appreciable longitudinal movement by the wall of the barrel 12. The slots 68 preferably project a short distance below the top surface of the central portion 30 of the diaphragm so that the latter may serve as a cushioning buffer against pin 66 to limit upward movement of the plunger.

The operation of the filling device is as follows:

The cap 60 is unscrewed from the end of the sleeve 42 swiveling on the plunger 36, whereupon the spring 64 will force the cap and plunger outwardly until the lower ends of slots 68 abut against the pin 66 as shown in Fig. 2. The pen point is then inserted in an ink well and the plunger rapidly reciprocated, preferably by applying the index finger to the top of the cap and grasping the barrel between the thumb and other fingers.

During the downward stroke against the pressure of the spring the diaphragm will roll upon itself from the position shown in Fig. 2 to a position substantially as shown in Fig. 1, displacing a certain amount of air which is ejected through the tube 24, duct 22 and lower portion 20 of the ink groove. Upon relieving the finger pressure on the cap 60, the spring will force the plunger upwardly, causing a partial vacuum within the barrel and consequently flow of ink into the barrel under atmospheric pressure. The ink will enter the barrel through the ink groove 21 or through both the ink groove 21 and air tube 24, depending upon the degree of vacuum produced.

During the initial portions of the second and subsequent depressions of the plunger, the pressure in the barrel will be raised above atmospheric and the ink which stood in the air tube 24 (at approximately the same level as the ink in the barrel) will be ejected. At this time a certain volume of ink will be forced from the barrel through the ink groove 20, 21 but due to the fact that there is a much smaller quantity of ink in the tube 24 and duct 22 than in the barrel, the ink will be exhausted from the former before an appreciable volume of ink has escaped from the barrel through the groove 20, 21. Upon continued downward movement of the plunger after the ink has been exhausted from the tube 24 and duct 22, the air in the barrel, due to its much greater fluidity, will be forced from the barrel through the groove 20, 21 much more rapidly than ink is ejected. The ratio of air and ink ejected from the barrel is dependent upon the speed of the depression stroke of the plunger.

The fact that the cross sectional area of groove 20, 21 is less than that of the tube 24 and duct 22 (and consequently its resistance to flow greater) is a factor which aids in reducing the proportion of ink expelled upon each depression of the plunger.

That the barrel is full of ink may be sensed because correct pressure is required to operate the plunger and also because air is no longer ejected from the pen point.

During the reciprocation of the plunger the diaphragm 26, due to the way in which it is secured to the barrel and to the plunger and also due to its flexibility and resiliency, will not buckle or fold but will roll smoothly from one end of its stroke to the other. The sleeve 42 has a sufficiently long guiding surface for the plunger 36 so that the movement of the latter and also the central portion of the diaphragm will be limited to straight line reciprocation.

After the pen barrel is completely filled with ink the cap 60 is screwed over the end of the sleeve 42. Since the nut 44 is screwed into the barrel so far that it lies slightly below the level of the end of the barrel, manipula-

tion of the cap cannot change the adjustment of the nut.

Should it at any time become necessary to remove the filling device from the barrel for cleansing or repair, the device may be withdrawn as a unit after unscrewing the nut 44. The edge of the diaphragm is preferably cemented to the wedge portion 40 of the sleeve 42 so that if the filling device should be removed from the barrel by a novice it will be correctly positioned when the device is again inserted in the barrel. Since it is unnecessary to rotate the diaphragm when inserting it in the barrel and since the flange 50 prevents the diaphragm from slipping upwardly on the wedge 40, the proper positioning of the diaphragm is assured.

In Figs. 4 to 10, inclusive, I have illustrated various modifications of my invention, and since the modified structures in construction and operation are generally similar to the device above described, I have applied similar reference characters to corresponding parts and will hereinafter point out and particularly describe only the parts and features in which the modifications differ from the structure shown in Figs. 1, 2 and 3.

The modification shown in Figs. 4 and 5 is provided to overcome a seeming disadvantage of the structure previously described in that the downward stroke of the plunger of the latter is limited by the contact of the lowermost thread in the cap with the uppermost thread on the sleeve 42, thus decreasing the plunger displacement and increasing the number of strokes necessary to fill the barrel.

In the modification (Figs. 4 and 5) the plunger 70 has a portion 72 of increased diameter which is threaded in a bushing 74 fixed in a cap 76. The upper end of the plunger is closed and has a laterally extending annular flange 78 which is of greater diameter than the inside diameter of the bushing 74.

As shown in Fig. 4, the bushing 74 is normally threaded over the end of sleeve 80 which is held in the barrel by a nut 82.

When the cap 76 is unscrewed from the sleeve it will simultaneously unscrew from the plunger also. Continued rotation of the cap after it is released from the threads of the sleeve will raise the cap further relative to the plunger. This upward movement of the cap is limited by the abutment of the flange 78 with the upper end of the sleeve 74 as shown in Fig. 5. With the parts in this position a longer plunger stroke is possible, since the plunger may move a distance equal to the full length of the slots 68 in the plunger, and is not limited by the abutment of the threads in the bushing 74 with the threads on the sleeve 80.

In the modification shown in Figs. 6, 7 and 8 the bore of sleeve 84 tapers outwardly at its upper end and plunger 86 is complementally

tapered at 88 so that the plunger may be wedged into the sleeve and thus held in its lower position after completion of the filling operation. The angle of the taper on the sleeve and on the plunger is such that it requires a little more than the ordinary operating pressure to wedge the plunger tightly in the sleeve.

The pen shown in Figs. 9 and 10 comprises the usual barrel 90, the lower end of which is threaded to receive a plug 92. A feed bar 94 is fitted in the plug and has a channel 96 formed therein beneath the pen point. An open end tube 98 communicating with the channel 96 and having a small ink port 100 is fixed in the upper end of the feed bar so as to extend coaxially with the barrel 90.

A shoulder 102 near the upper end of the tube 98 provides a seat for a disc 104 which may have a plurality of notches 106 in its periphery or be otherwise suitably apertured to permit ink to flow freely from the upper to the lower portion of the barrel.

A conical helical spring 108 is slightly compressed between the disc 104 and the end of a piston 110 which may be suitably recessed as at 112 to hold the spring in position. The disc aids in centrally supporting the air tube 98 and in this construction the spring 108 and the disc 104 may be readily withdrawn from the barrel for cleansing upon the removal of the plug 92 and the parts which are secured thereto.

The piston 110 is grooved to receive a piston ring 114 which is preferably made of highly elastic rubber. The piston has a neck portion 116 over which a hollow frusto-conical elastic diaphragm or sealing member 118 is positioned, fitting between the end portion of the neck 116 and the walls of a cylindrical recess in the end of the finger piece, plunger or actuating stem 120.

The skirt portion of the sealing member 118 is bent back upon itself as indicated at 122 and is cemented or otherwise suitably secured to the outer surface of a guide sleeve 124 which is threaded in the upper end of the barrel and is provided with a guiding stop through its engagement with the complementary circumferential projection 128 on the stem 120. This method of sealing the plunger in the barrel eliminates the necessity of gaskets or fluid tight sliding fits and makes leakage from the upper end of the barrel impossible, since it has been found that with reasonable care a sealing member made of the proper quality of rubber will outlive the useful life of the pen.

The upper end of the sleeve 124 is threaded to receive a cover cap 130, which protects the stem 120 against accidental reciprocation.

The spring 108 is preferably gold-plated to prevent its corrosion by the ingredients

of the ink. Due to the rubbing action between the coils of the spring and against the walls of the barrel, the gold plate (which for practical reasons must be very thin) will normally wear away in spots in a relatively short time. I preclude this possibility by fixing small globules 132 of solder or other suitable material at short intervals along the spring wire. These globules prevent contact of the gold plate of one turn of the spring wire with that of the adjacent turns, the barrel wall, or the air tube 98.

The operation of the modified structure of Figs. 9 and 10 is similar to that of the filling devices previously described. The piston 110 with its ring 114 is practically air and ink tight so that the displacement per unit length of plunger stroke is slightly greater in this modification than in the structures previously described.

The ink aperture 100 is spaced a short distance above the lower end of the barrel so that a small quantity of ink will be retained in the barrel at all times, thus aiding in the preservation of the rubber parts by keeping them moist, and preventing the ink from drying up and clogging the passageways.

In Fig. 11, I have illustrated a modified construction of the sealing member and the related parts. In this embodiment the sealing member 51 has its edge held against a tapering surface 53 of the barrel by a wedge shaped ring 55. Rubber cement is preferably used to hold these parts in position to make an impervious seal. A telescoping member or sleeve 57 fits freely over the end of the tube and has a shelf 59 or other suitable abutment formed integrally therewith. A helical spring 61 is compressed between the shelf 59 and a disc 63 which is secured to or formed integrally with the tube 15, tending normally to hold the sleeve in its upper position. A plunger or finger piece 65 is guided in a head 67 which threads into the end of the barrel, preferably having left hand threads. The lower end of the finger piece engages the central portion of the sealing member 51, pressing it into a shallow socket 69 in the upper end of the sleeve 57, thus maintaining these parts in alignment.

The piece 65 has a frusto-conical surface 67 adjacent its lower end to provide a backing or support for the sealing member when the finger piece is depressed, and also to provide a shoulder which abuts the annular inward projection 69 on the head 67 to limit the upward movement of finger piece 65 and consequently that of the sleeve 57 and the sealing member 51. If desired, the sleeve 57 may be provided with a plurality of apertures to facilitate the admission of air to the end of the tube 15 and to permit the ink to flow therefrom more freely.

In this embodiment the rubber sealing member is free from sharp bends which, of

course, tends to lengthen its life. The diameter of the threaded portion of the head 67 over which the cover cap 71 is screwed is of smaller diameter than the threaded portion which screws into the barrel. This construction makes it easy to unscrew the cover cap without unscrewing the head from the barrel because a greater turning moment is exerted at the threads engaging the cap than at the threads engaging the barrel.

This application is a continuation of my application, Serial No. 306,009 filed September 14, 1928, entitled "Fountain pens" which application in turn is a continuation in part of my application, Serial No. 149,817 filed November 22, 1926.

While I have shown and described particular embodiments of my invention, it will be apparent to those skilled in the art that numerous variations and changes may be made without departing from the principles thereof, and I therefore wish my invention to embrace all such changes, variations, modifications and substitutions as will naturally suggest themselves to persons skilled in the fountain pen art.

What is claimed, is:

1. In a fountain pen having a barrel, a feed bar secured to one end of said barrel and having ink and air passageways formed therein, an air tube connected with said air passageway and extending a substantial distance into said barrel, and filling means located in the other end of said barrel comprising a reciprocable plunger, a spring tending to urge said plunger outwardly, and a pliable sealing member having its peripheral edge fixed relative to said barrel and having its central portion engaged by said plunger and adapted to be reciprocated thereby.

2. In a fountain pen having a barrel, a feed bar secured in one end of said barrel and having ink and air passageways formed therein, an air tube connected with said air passageway and extending a substantial distance into said barrel, and filling means for said barrel comprising a reciprocable plunger, a spring tending to urge said plunger outwardly, means to limit the reciprocating movement of said plunger, and a pliable sealing member having its peripheral edge fixed relative to said barrel and having its central portion engaged by said plunger and adapted to be reciprocated thereby.

3. In a fountain pen having a barrel serving as an ink reservoir, a feed bar secured in one end of said barrel and having ink and air ducts formed therein, means forming an air passageway connected with said air duct and extending longitudinally a substantial distance into said barrel, and means for filling said reservoir comprising a sleeve secured in the other end of said barrel, a sealing member carried by said sleeve and extending across the end of said barrel, manipulative

means slidable from normal position in said sleeve to deform said member, and resilient means to return said member and manipulative means to normal position.

4. In a fountain pen filling device, a barrel, a feed bar secured in one end of said barrel and having ink and air passageways formed therein, an air tube connected with said air passageway and extending a substantial distance into said barrel, and means for creating pressures greater and less than atmospheric in said barrel, said last named means comprising a pliable normally conically-shaped element fixed relative to said barrel to close one end thereof, means to turn said conical element inside out, and resilient means to return said element to normal position.

5. In a fountain pen, the combination of a barrel, a feed bar carried in said barrel and having a passageway for air and for ink, means for conducting air from a point adjacent the end of the barrel opposite said feed bar to said passageway, and means for alternatively creating sub and super atmospheric pressures in said barrel, said last named means comprising a flexible diaphragm mounted at the other end of said barrel, manipulative means for moving the central part of said diaphragm inwardly, and resilient means for moving the central part of said diaphragm outwardly thereby to vary the pressure within the barrel.

6. In a fountain pen, the combination of a barrel, a sleeve secured in the end of said barrel, said sleeve having an end portion spaced from the walls of the barrel, a flexible diaphragm fitting over the end of said sleeve and secured thereto, the greatest external diameter of said diaphragm being less than the least internal diameter of said barrel, whereby said sleeve and diaphragm may easily be removed from said barrel as a unit, and manipulative means guided in said sleeve and removable therewith, said means being adapted to move a portion of said diaphragm to and fro.

7. A self filling fountain pen comprising a barrel having a feed bar secured in one end thereof, said feed bar having an ink and an air passageway associated therewith, said air passageway extending a substantial distance longitudinally of said barrel, and barrel filling means at the other end thereof, said filling means comprising a flexible diaphragm, a manually reciprocable member connected to the central portion of said diaphragm, and means securing the peripheral portion of said diaphragm to said barrel at an acute angle relative thereto so that when said member is moved to the end of its stroke into the peripheral portion the angle of said peripheral portion to the remaining portion of said diaphragm is less than ninety degrees.

8. In a fountain pen filling device, the

combination of a sleeve, a pin passing diametrically through said sleeve, a reciprocable plunger guided in said sleeve, and a flexible diaphragm having its peripheral edge secured relative to said sleeve and its central portion attached to said plunger.

9. In a fountain pen filling device, the combination of a sleeve having a threaded end, a reciprocable plunger guided in said sleeve, a flexible diaphragm having its edge encircling said sleeve and its central portion secured to said plunger, and a cap rotatably secured to said plunger and having a threaded bore cooperable with the threaded end of said sleeve.

10. In a fountain pen, the combination of filling means, a plunger for operating said filling means, a threaded portion near the end of said plunger, externally threaded means for guiding said plunger, and an internally threaded cap screwed over the threaded portions of said plunger and said guiding means.

11. In a fountain pen, the combination of a barrel, filling means in said barrel, a plunger for operating said filling means projecting from the end of said barrel, a cap threadedly joined to said plunger and barrel, and cooperative means on said plunger and cap to prevent separation thereof.

12. In a fountain pen filling device, the combination of a sleeve, a slotted reciprocable plunger guided in said sleeve, a flexible diaphragm having portions thereof secured to said plunger and sleeve respectively, a pin diametrically mounted in said sleeve and passing through the slots in said plunger, and a spring compressed between said pin and plunger.

13. In a fountain pen filling means, the combination of a flexible diaphragm, a plunger secured to the central portion thereof, a pin, a spring between said pin and plunger, and integral means for guiding said plunger, carrying said pin and supporting the peripheral edge of said diaphragm.

14. In a fountain pen filling device, the combination of a flexible diaphragm, a plunger attached to the central portion thereof, a threaded cap rotatably secured to said plunger, and integral means for guiding said plunger, supporting the peripheral portion of said diaphragm, and having threads cooperable with the threads in said cap.

15. In a fountain pen, the combination of a barrel, a filling device, a plunger for operating said filling device and projecting from the end of said barrel, said plunger having a plurality of open end slots and an outwardly projecting flange at its outer end, and a cap adapted to be attached to the end of said barrel, said cap having an undercut annular groove to receive the flange on said plunger.

16. In a fountain pen having a barrel, fill-

ing means comprising a reciprocable plunger, a spring tending to urge said plunger outwardly, and a pliable imperforate member having its peripheral edge fixed relative to said barrel and having its central portion adapted to be actuated by said plunger.

17. In a fountain pen having a barrel, filling means therefor comprising an element manually operable in one direction, a spring for moving said element in the opposite direction, and a flexible member closing the end of said barrel, said member being adapted to be moved to and fro by said element.

18. In a fountain pen filling device, the combination of a sleeve, a reciprocable plunger guided in said sleeve, a flexible diaphragm having its edge surrounding said sleeve and its central portion engaged by said plunger, a cap carried by said plunger, and cooperative quick detachable connecting means on said sleeve and on said cap.

19. In a fountain pen filling device, the combination of a flexible diaphragm, a plunger for reciprocating the central portion of said diaphragm, a spring for urging said plunger in one direction, and integral means for guiding said plunger, supporting the edge of said diaphragm and one end of said spring.

20. In a fountain pen filling device, the combination of a barrel, a sleeve secured in the upper end of said barrel, a plunger reciprocable in said sleeve, and a flexible diaphragm having portions held by said sleeve and said plunger, respectively, said sleeve and plunger having interengaging wedging surfaces whereby said plunger may be fixed in said sleeve.

21. In a fountain pen, the combination of a barrel having a shoulder adjacent one end thereof, filling means comprising a flexible diaphragm having its peripheral edge seated against said shoulder, a sleeve for pressing said edge of said diaphragm against said shoulder, a plunger for moving the central portion of said diaphragm to and fro, and a nut rotatable relative to said sleeve and threaded in the end of said barrel to force said sleeve into said barrel.

22. In a fountain pen, the combination of a barrel having a sloping annular shoulder at one end thereof, a flexible sealing member having its peripheral edge resting on said shoulder, a sleeve having a surface complementary to the surface of said shoulder and arranged to press the peripheral edge of said diaphragm against said shoulder, and a nut swiveled on said sleeve and threaded in the end of said barrel and adapted to force said sleeve inwardly thereby to clamp said diaphragm in said barrel.

23. In a fountain pen having a barrel serving as an ink reservoir, means for filling said barrel comprising a sleeve secured at the end of said barrel, a pliable sealing member con-

fining within said barrel, said member being fastened to said sleeve, being of slightly lesser diameter than the internal diameter of the end of said barrel and removable from said barrel with said sleeve, said sleeve and member closing the end of said barrel, and means to move a portion of said member to and fro to create differential pressures in said barrel.

24. In a fountain pen having a barrel serving as an ink reservoir, a feed bar secured in one end of said barrel and having ink and air passageways formed therein, an air tube communicating with said air passageway and extending into said barrel, and means for creating pressures in said barrel alternately greater and less than atmospheric pressure, said means comprising a substantially conical sealing member closing the other end of said barrel, means to hold the edge portion of said member stationary relative to said barrel, means to move the central portion of said member to and fro to cause the intermediate portions of said member to roll freely relative to one another, thereby creating differential pressures in said barrel, and a spring to move said last named means in one direction.

25. In a fountain pen having a barrel, a feed bar secured in one end of said barrel and having ink and air passageways formed therein, an air tube communicating with said air passageway and extending into said barrel, and means for creating pressures in said barrel alternately greater and less than atmospheric pressure, said means comprising a substantially conical diaphragm secured within the other end of the barrel and having its edges fixed relative to said barrel, said diaphragm being capable of rolling freely upon itself and turning inside out to vary the effective volume of said barrel when the central portion of the diaphragm is reciprocated, means for moving the central portion of said diaphragm in one direction, and resilient means to move said central portion in the opposite direction.

26. In a fountain pen filling means, the combination of a barrel forming an ink reservoir, a feed bar secured in one end of said barrel and having ink and air passageways formed therein, an air tube communicating with said air passageway and extending into said barrel, and means for creating pressures in said barrel alternately greater and less than atmospheric pressure, said means comprising a flexible diaphragm having its peripheral edge fixed relative to said barrel, a manually reciprocable plunger engaging the central portion of said diaphragm, means to limit the stroke of said plunger sufficiently at all times to maintain a bend U-shaped in cross section in said diaphragm, and resilient means to move the central portion of said diaphragm in one direction.

27. In a fountain pen filling means, the

combination of a barrel forming an ink reservoir, a flexible diaphragm closing one end of said barrel, a plunger normally protruding from the end of said barrel and adapted to be manually reciprocated, the inner end of said plunger engaging a portion of said diaphragm, a tube providing a passageway for air from said barrel, and a compression spring surrounding said tube and compressed upon inward movement of said plunger.

28. In a fountain pen filling device, the combination of a barrel forming an ink reservoir, a tube providing a passageway for the discharge of air from said barrel, a plunger reciprocable in said barrel and guided partially by said air tube, a flexible diaphragm having a portion fixed relative to the walls of said barrel and a portion movable with said plunger, and a spring surrounding said air tube and operative to move said plunger outwardly.

29. In a fountain pen filling device, the combination of a flexible diaphragm, a plunger for reciprocating the central portion of said diaphragm, a spring for urging said plunger in one direction, and integral means for guiding said plunger and supporting one end of said spring, said means being connected to said plunger and the central portion of said diaphragm.

30. In a fountain pen filling device, the combination of a barrel forming an ink reservoir, a flexible diaphragm having its edge fixed relative to said barrel at one end thereof, manually operable means for moving the central portion of said diaphragm inwardly, a spring for moving the central portion of said diaphragm outwardly, and a rigid member interposed between said diaphragm and said spring and adapted to transmit the force of said spring to said diaphragm.

31. In a fountain pen filling device, a barrel forming an ink reservoir, a diaphragm closing one end of said reservoir for varying the pressure therein, an air tube extending from the pen point end of said barrel to a point adjacent the other end of said barrel, a spring within said barrel to move a portion of said diaphragm in one direction, and guide means fitting around said air tube, said means engaging said spring and adapted to be moved thereby in one direction and manually moved in the opposite direction.

32. A fountain pen comprising a barrel, a plunger reciprocable therein, a spring urging said plunger outwardly, a channeled feed bar fitted in one end of said barrel, a tube extending inwardly from said bar and having its passage communicating with the channel of said bar, and an apertured member carried by said tube adjacent its inner extremity, contacting with the walls of said barrel and serving as a seat for said spring.

33. In a self-filling fountain pen having a reservoir barrel, a reciprocable member for

creating less and greater than atmospheric pressures therein, a guide sleeve therefor threaded in the end of said barrel, and a cap threaded on said sleeve, the portion of said sleeve threaded in said cap being of lesser diameter than the portion threaded in said barrel.

34. In a self-filling fountain pen, the combination of a barrel, a feed bar secured to one end of said barrel and having ink and air passageways formed therein, an air tube extending into said barrel, secured to said feed bar and communicating with said air passageway; and filling means at the other end of said barrel, said means comprising a slidable plunger having a stem, a spring urging said plunger outwardly, a conical sealing member closing the end of said barrel and normally fitting over said stem, and a reciprocable finger piece protruding from the end of said barrel and having its inner end engaging said member, whereby said plunger may be depressed, causing said member to be unfurled from said stem and thereby vary the effective volume of said barrel.

35. In a fountain pen having a barrel, means for varying the pressure in the barrel comprising a spring returned plunger reciprocable in said barrel, a plunger stem, a flexible tapered sealing member secured to said barrel and normally fitted to said stem, and a recessed finger piece adapted to engage the end of said stem whereby said plunger may be depressed.

36. In a device of the class described, the combination of a cylinder, an element reciprocable therein, a coil spring within said cylinder for moving said element, and a plurality of globules of solder secured to said spring to form lateral bearing points therefor.

37. In a device of the class described, a liquid receptacle, a plated coil spring therein, and means to prevent abrasion of the plating from said spring comprising a plurality of globules of a soft metal spaced along said spring.

38. As an article of manufacture a plated coil spring having drops of a bearing metal fixed at intervals of its length to prevent abrasion of the plating.

39. In a fountain pen, the combination of a barrel having a male threaded part at the end thereof, filling means in said barrel, a plunger for operating said filling means projecting from the end of said barrel and having a male thread at the projecting end thereof, and a cap loosely threaded on the threaded end of said plunger and on the threaded part of said barrel, whereby unscrewing said cap from said part will result in simultaneously unscrewing the cap relative to said plunger thereby to lengthen the effective stroke of said plunger.

40. A fountain pen comprising a barrel,

- a feed bar having ink feeding and air conducting passageways formed therein and secured in one end of said barrel, an air tube communicating with said air passageway and extending within said barrel substantially the length thereof, and means at the other end of said barrel for alternately creating pressures greater and less than atmospheric pressure within said barrel, said means comprising a flexible cup having its open end fixed relative to said barrel, a manually engageable plunger for deforming said cup to expel the contents thereof, and a spring for moving said plunger in one direction.
41. A fountain pen filling device of the character adapted to be inserted in and removed from the fountain pen barrel as a completely assembled unit comprising a diaphragm adapted to be expanded and collapsed, a plunger for actuating said diaphragm, spring means to move said plunger in one direction, means for supporting said diaphragm, said plunger and said spring means, and means adapted to engage the barrel of a fountain pen for locking the filling device in operative position therein.
42. A filling device for fountain pens of the type adapted to be detachably secured in the barrel of a fountain pen comprising a flexible diaphragm, a member for supporting the peripheral edge portion of said diaphragm, a plunger guided by said member and secured to the central portion of said diaphragm, resilient means for moving said plunger in one direction, and means for detachably securing said member, diaphragm, plunger and resilient means in the end of a barrel of a fountain pen, said securing means being operative to force said member and parts associated therewith into the barrel of the fountain pen by a translational movement relative to the barrel of the fountain pen.
43. In a fountain pen having a barrel, filling means therefor which comprises a flexible member sealing one end portion of the barrel, a ring member cooperating with the inner wall of the barrel to secure said flexible member in place, a plunger member attached to said sealing member for flexing the same to vary the air pressure in said barrel, resilient means for returning the plunger to its normal position, and another member threadedly engaged with the barrel at said one end and guiding the movements of said plunger member.
44. In a fountain pen having a barrel, filling means therefor which comprises a flexible member sealing one end portion of the barrel, a ring member shaped for wedge-engaging said flexible member with the inner wall of the barrel, and another member threadedly engaged with the barrel, at said one end and adapted to force said ring member into and hold it in its said wedge-engaging position.
45. A filling mechanism adapted to be inserted in the barrel of a fountain pen which comprises a plurality of parts interconnected to form a self-contained unit with the parts thereof adapted to be held operatively connected when in or when removed from said barrel, said parts including a diaphragm member adapted to seal one end of said barrel, a support therefor, and an actuator connected to said diaphragm member.
46. In a fountain pen, a barrel and filling mechanism adapted to be mounted therein which comprises a reciprocable plunger member, a guide for said plunger, means cooperatively connected to said plunger member for varying the air pressure in said barrel, and means located between said plunger member and said guide and selectively effective under the control of the operator for holding said plunger member in an inwardly-reciprocated position.
47. In a fountain pen, a barrel and filling mechanism adapted to be mounted therein which comprises a reciprocable plunger member, a guide for said plunger, means cooperatively connected to said plunger member and said guide, for varying the air pressure in said barrel, and means between said plunger member and guide adapted in an inwardly-reciprocated position of said plunger member to hold said plunger in such inwardly-reciprocated position.
48. A self-contained filling mechanism adapted to be inserted in the barrel of a fountain pen which comprises an extensible member for closing one end of said barrel and for varying the air pressure in the barrel, a support for said member, a plunger connected to said member for extending the latter, and means releasably engageable with the barrel securing said member, support and plunger in the barrel, said member, support and plunger being so interconnected that they may be withdrawn from the barrel as a unit upon release of said means without breaking their operating relationship.
49. In a fountain pen, a barrel filling mechanism therefor comprising an extensible member closing one end portion of said barrel, means fixing said member relative to the barrel wall at said one end, a plunger member for extending said extensible member, means guiding said plunger and having a projected threaded part, and a cap threadedly engaging said threaded part and shielding said one end of said barrel and the structure therein.
50. In a fountain pen, a barrel, filling mechanism therefor comprising an extensible member closing one end portion of said barrel, means fixing said member relative to the barrel wall at said one end, a plunger member for extending said extensible member, resili-

5 51. A filling mechanism in the form of a self-contained unit adapted to be inserted in and removed from the barrel of a fountain pen which comprises a flexible member adapted to span and seal the barrel adjacent one end thereof, a support for said member, an exteriorly accessible plunger reciprocable for flexing said member to vary the air pressure in the barrel, and means self-contained within said unit for limiting the reciprocating movement of said plunger.

52. In a fountain pen having a barrel, filling means therefor comprising a reciprocating pump adapted to be manually actuated, means tending normally to return the pump to its projected position and means for locking the pump to the barrel in its retracted position following the filling operation.

53. In a fountain pen, in combination, a barrel, a reciprocating plunger for filling the same, means for returning the plunger to its projected position following the depression thereof and means for securing the plunger relatively to the barrel in its depressed condition following the filling operation.

54. In a fountain pen, in combination, a barrel, a flexible diaphragm located therein, a reciprocating plunger for moving said diaphragm back and forth for filling the pen, spring means for urging the plunger in a projected position and means for securing the plunger to the barrel in its depressed position following the filling operation.

55. In a fountain pen, in combination, a barrel, a flexible diaphragm situated therein, a plunger adapted to be moved back and forth for actuating said diaphragm whereby to fill the barrel and interlocking means associated with the plunger and barrel, respectively, for locking the plunger to the barrel in its depressed position following the filling operation.

56. In a fountain pen, in combination, a barrel, filling means for said barrel, comprising a diaphragm, a plunger operatively secured to said diaphragm for moving the same repeatedly whereby to fill the barrel, means tending normally to return said plunger to its projected position and means adapted to lock the plunger relative to the barrel when in its depressed condition, said last mentioned means including a rotatable connection.

57. In a fountain pen, in combination, a barrel, a flexible diaphragm disposed therein, a plunger connected to said diaphragm and adapted to be moved to and fro whereby to fill the pen, resilient means tending normally

to return the plunger to its projected open position and a rotatable connection between said plunger and barrel whereby the plunger may be locked to the barrel when in its depressed condition following the filling operation.

In testimony whereof I affix my signature.
ARTHUR O. DAHLBERG.

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