

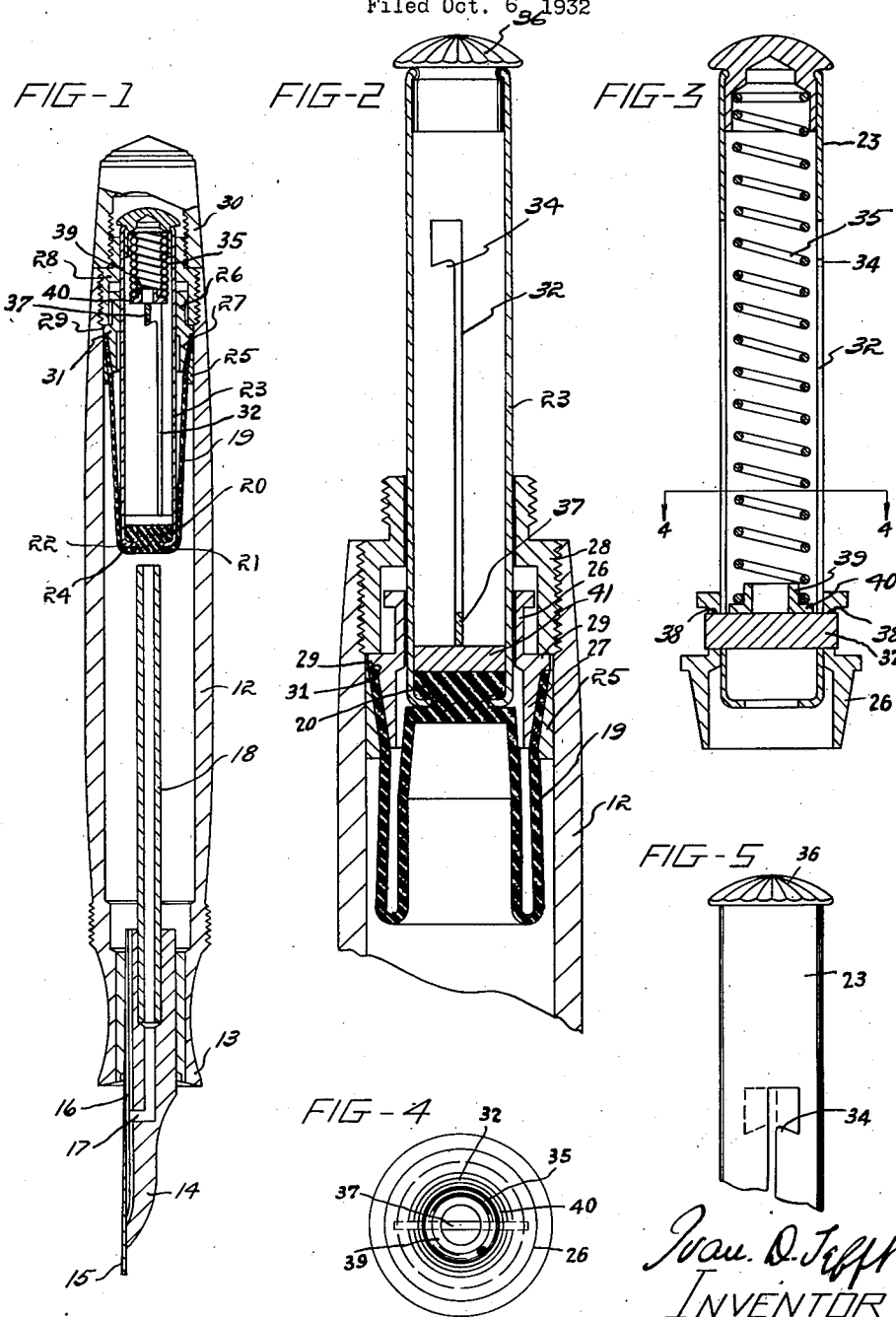
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I. D. TEFFT

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FOUNTAIN PEN FILLING DEVICE

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Juan D. Tefft
INVENTOR

BY *Juan D. Tefft*
ATTORNEY

UNITED STATES PATENT OFFICE

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FOUNTAIN PEN FILLING DEVICE

Ivan D. Tefft, Janesville, Wis., assignor to The Parker Pen Company, Janesville, Wis., a corporation of Wisconsin

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My invention relates to fountain pens and more particularly to the filling means therefor, and this application is specifically directed to improvements of the device disclosed in the patent to Arthur O. Dahlberg, 1,904,358, issued April 18, 1933.

The principal objects of my invention are to provide:

First: An improved filling device employing the vacuum pump principle as is disclosed in the Dahlberg patent above mentioned, but having means for positive locking of the pump plunger in the closed position;

Second: A vacuum pump filling mechanism employing a rubber diaphragm somewhat similar to that disclosed in the Dahlberg patent hereabove mentioned, and having improved means for locking the diaphragm onto the plunger;

Third: A novel and improved assembly of the units constituting the said vacuum pump;

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

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

Fig. 1 is a longitudinal sectional view 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 longitudinal sectional view of an assembly of the more important parts of the filling mechanism;

Fig. 4 is a transverse sectional view of the filling mechanism on the line 4—4 of Fig. 3; and

Fig. 5 is a fragmentary plan view of the plunger portion of the filling mechanism disclosing a portion of the cam lock mechanism which is to be specifically described hereafter.

The pen comprises a barrel 12, which is of one-piece construction, the usual threaded and detachable section being eliminated, the said section being a continuation and part of the barrel, which construction eliminates the possibility of leakage which might occur were the section a separate unit.

For the purpose of clarifying the description, the section will hereafter be referred to as a separate part and will be designated by the numeral 13.

A feed bar 14 and a pen point 15 are secured in the section in the customary manner. The feed bar has a longitudinal ink feeding channel

16 and is axially drilled to provide an air duct 17, which duct interconnects the said channel at a point approximately midway its length. An air tube 18 is press-fitted into the enlarged upper end of the duct 17 and extends upwardly into the barrel a predetermined distance. The said feed and air tube are of the type exemplified in the patent to Taylor, Number 802,668, dated October 24, 1905, and are well-known in the art.

The upper end of the barrel is closed by a pliable sealing member or flexible diaphragm 19 made of rubber or other flexible and ink proof material. The said diaphragm is frusto-conical in shape and has projecting from the lower-most portion thereof a lug 20 having a shallow annular groove 21 formed therein to receive an inwardly extending annular flange 22 of a tubular plunger 23.

The lug 20 of the diaphragm is of the same material as the said diaphragm and is formed thereon by a molding process. When received from the molder, the diaphragm is in an inverted position, the lug being on the outside, but when assembled onto the filling device the said diaphragm is turned inside out so that the lug is situated on the inside of the cup so formed. By the turning of the diaphragm inside out as to position the lug within it, an initial bend is made at the point 24 in the diaphragm which aids in causing the diaphragm to roll freely upon itself, the purpose of which will more fully appear hereafter.

The peripheral edge of the diaphragm is pressed or clamped against a tapering annular shoulder 25 formed in the barrel 12 by the complementarily tapering ring portion 27 of the sleeve 26 which encircles the tubular plunger 23. The said sleeve 26 is forced into the barrel by an annular nut 28 which is threaded in the end of the barrel and engages a shoulder 29 on the sleeve 26. The upper portion of the nut 28 is of less diameter than that portion of it which is adapted to be screwed into the barrel and is threaded to receive a covering cap 30. The nut 28 is adapted to be screwed into the barrel so that the shoulder formed by reducing the upper end thereof is flush with the top edge of the said barrel. The distance between the tapered annular portion 25 and the top edge of the barrel is such that upon the assembly of the unit into the barrel, and the nut 28 being rotated to firmly lock the diaphragm in position, the shoulder on the said member 28 will be flush with the top edge of the said barrel.

The sleeve 26 has an annular shoulder 31 at the upper end of the tapered portion 27 which is of

substantially the same diameter as the inside of the barrel, and which limits the upward movement of the diaphragm on the wedge or tapered portion 27 when the assembled filling mechanism is being inserted into the barrel.

The sleeve member 26 is axially drilled and has a larger bore at the bottom end thereof to provide clearance for the diaphragm when it is at the upper end of its stroke.

The tubular plunger 23 has spaced, aligned slots 32 stamped therein and at the upper end of said slots the metal is blanked away as to form a cam shoulder 34, the aperture formed in the blanking being in one of the slots on the lefthand side of said slot, and the other on the righthand side. The purpose of the slots, cam shoulders and apertures will be more fully explained hereafter.

A compression coil spring 35 is confined between a button 36 (which is fixed in the end of the plunger 23) and a pin 37 which passes through the longitudinally extending slots 32 in the plunger 23, the ends of said pin resting in aligned apertures 38 formed in the sleeve 26.

Inasmuch as that portion of the nut 28 which is adapted to be screwed in the barrel surrounds that portion of the wedge member 26 which is slotted to receive the pin 37, lateral movement of the said pin is prevented; thus when the assembly is completed, the pin cannot become disengaged from the apertures in which its ends rest.

In order that the lowermost portion of the spring may have a better contact with the pin 37, a spring seat 39 is provided, the said spring seat having an annular shoulder 40 on which the spring is seated as is disclosed in Fig. 3.

The assembly of the mechanism is as follows:

A circular hard rubber plug 41 is force fitted into the top end of the plunger 23 and pressed to a point near the bottom thereof. The spring 35 is next slipped into the plunger, whereupon the cap 36 is affixed to the end effectually closing the said plunger assembly.

The circular nut 28 is then slipped over the plunger from the lowermost end, and following this the wedge member 26 is also slipped over the end, whereupon the pin 37 is slipped through one of the apertures in the side of the wedge member under the spring and into the aligned slot on the opposite side of the said wedge member. The lug 20 on the diaphragm is then forced into the aperture on the lowermost end of the plunger and because of its conformation the inturned edge of the said plunger will engage in the recess in the said lug thus affixing the diaphragm to the end of the plunger. A thin-bladed tool is slipped between the slots in the sides of the plunger directly over the rubber plug 41 and by pressing down on this thin tool the rubber plug is pressed down upon the soft rubber diaphragm lug causing it to expand and firmly locking it in the end of the tube 23.

This rubber washer 41 serves the dual purpose of locking the diaphragm onto the end of the plunger and of acting as a buffer against which the pin 37 will strike in its downward movement. The buffer being of sufficient thickness so that when it is wedged down tightly onto the diaphragm lug, the top face of it will extend above the lower edges of the slots 32, and thus limit further upward movement of the plunger.

After the assembly of the various elements of the pump mechanism is completed, the diaphragm is turned inside out and the top peripheral edge thereof is slipped over the tapered

face of the wedge member 26. The assembler then grasps the tapered portion of the wedge member 26 in his right hand and presses down on the plunger, whereupon the pin 37, being suspended between the two apertures in the member 26 will cause the spring 35 (which is limited by the button 36 and the said pin 37) to be compressed.

It is to be noted that due to the fact the pin 37 is held in a stationery position, downward movement of the plunger will cause the pin to approach the top cut-out portion of the said slots 32. Upon reaching the uppermost limit of the slot 32, the assembler rotates the plunger in a counter clockwise direction, whereupon the pin will ride over the cam shoulder 34 and come to rest on the angle face of the said cam shoulder, thus securely locking the plunger in closed position. The unit is then fitted into the upper end of the barrel so that the tapered face of the member 26 will bear against the peripheral edge of the diaphragm which, in turn, contacts the complementally tapered annular shoulder 25 in the barrel. The annular nut 28 is then threaded into the complemental threads on the interior of the barrel until sufficient tension has been exerted on the wedge member 26 to cause a tight liquid-proof joint between the diaphragm and the complementally tapered ring portion 25 in the barrel.

The operation of the filling device is as follows:

The cap 30 is unscrewed from the end of the annular nut 28 and through the medium of the button 36 the plunger 23 is rotated in a clockwise direction thus releasing the locking pin 37 from engagement with the locking cams in the upper portion of the slots 32. The spring will then draw the plunger upward and, of a consequence, will cause the diaphragm to roll upon itself. The pen point is then inserted in the inkwell and the plunger slowly 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, as stated before, 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 18, duct 17 and ink channel 15. Upon relieving the finger pressure on the cap 36, the spring will force the plunger upwardly causing a partial vacuum within the barrel and a consequent flow of ink into the barrel under atmospheric pressure. The major portion of the ink will enter the barrel through the ink channel 16 but if the vacuum produced by the pump is sufficient, a small quantity of said ink will also enter through the air tubes 17 and 18.

During the initial periods of the second and subsequent depressions of the plunger, the pressure in the barrel will be raised above atmospheric and the ink which stands in the air tube 18 (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 channel 16 but due to the fact that there is a much smaller quantity of ink in the tube 18 and duct 17 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 ink channel 16.

Upon continued downward movement of the

plunger after the ink has been exhausted from the tube 18 and the duct 17, the air in the barrel, due to its much greater fluidity, will be forced from the barrel through the said air tube 18 and the duct 17 with much more rapidity than ink is ejected through the feed channels 16.

The ratio of the air and ink ejected is dependent upon the speed of the depression stroke of the plunger and the relative proportions between the areas of the duct 17 and the feed channel 16. The fact that a cross sectional area of the ink channel 16 is less than that of the tube 18 and the duct 17 (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 greater pressure is required to operate the plunger and also because air is no longer ejected from the pen point. When the pen is filled and on the last downward stroke of the plunger, the plunger is rotated in a clockwise direction and the consequent engagement of the pin 37 with the cams on the upper end of the tube 23 will cause the plunger to be locked in closed position thus permitting the assembler to fit the blind cap 30 thereover.

It is important to note that the annular member 28 is so constructed as to present a threaded head when the blind cap is removed, which threaded head will take a threaded desk set taper as well as the blind cap.

Should it at any time become necessary to remove the filling device from the barrel for cleansing or repair, it may be withdrawn as a unit by unscrewing the nut 28, a special tool being required, which tool is adapted to clamp on the threaded end of the said nut with sufficient tension as to permit unscrewing of the nut and a consequent removal of the entire unit.

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 art.

Having described my invention, what I desire to secure by Letters Patent is:

1. In a fountain pen, the combination with a barrel serving as an ink reservoir, flexible means closing one end portion of the barrel and adapted to be flexed to vary the atmospheric pressure therein, means supporting said flexible means in said barrel, reciprocable means connected to said flexible means for flexing the latter, means for securing said support means in said barrel, both said support means and securing means having guide connection with said reciprocable means, said reciprocable means having an operating part projecting beyond one end of said barrel and said securing means, and means detachably carried by said securing means normally forming a continuation of said barrel and concealing said securing means and said operating part.

2. In a fountain pen, the combination with a barrel serving as an ink reservoir, flexible means closing one end portion of the barrel and adapted to be flexed to vary the atmospheric pressure therein, means supporting said flexible means in said barrel, reciprocable means connected to said flexible means for flexing the latter, means for

securing said support means in said barrel, both said support means and securing means having guide-support connection with said reciprocable means, said reciprocable means having an operating part projecting beyond one end of said barrel and said securing means, means for limiting the movement of said reciprocable means, and selectively effective means for locking said reciprocable means in one position of reciprocation.

3. In a fountain pen, the combination with a barrel serving as an ink reservoir, flexible means closing and sealing one end portion of the barrel and adapted to be flexed to vary the atmospheric pressure therein, means supporting said flexible means in sealed relation with respect to said barrel, reciprocable means connected to said flexible means for flexing the latter, means detachably connected to the barrel outwardly beyond said flexible member for securing said support means in said barrel, both said support means and securing means having guide-support connection with said reciprocable means, said reciprocable means having an operating part projecting beyond one end of said barrel and said securing means, means between said support means and said reciprocable means for limiting the movement of said reciprocable means, and selectively effective means cooperative with said limiting means for locking said reciprocable means in one position of reciprocation.

4. In a fountain pen, the combination with a barrel serving as an ink reservoir, flexible means closing and sealing one end portion of the barrel and adapted to be flexed to vary the atmospheric pressure therein, means supporting said flexible means in said barrel, reciprocable means connected to said flexible means for flexing the latter, means for securing said support means in said barrel, both said support means and securing means having guide-support connection with said reciprocable means, said reciprocable means having an operating part projecting beyond one end of said barrel, means for limiting the movement of said reciprocable means, and means cooperative with a part of said limiting means for locking said reciprocating means in one of its limits of reciprocation.

5. In a fountain pen, the combination with a barrel having a tapered seat therein and serving as an ink reservoir, filling mechanism which includes a sleeve member having an outer seat portion tapered complementally to said wall seat, a flexible member adapted to close one end portion of said barrel and having a circular edge part supported upon the tapered seat of said sleeve, another sleeve member threadedly engaged with said barrel outwardly beyond said first sleeve and adapted as it is screwed into the barrel to engage said first sleeve and move it axially to secure the circular edge of said flexible member between said tapered seats in seal tight fashion, a reciprocable member slidably supported by both said sleeve members for flexing said flexible member, said reciprocable member having an operating part projected beyond said second sleeve member, and a cap member detachably mounted on said second sleeve member for concealing the latter and the operating part of said reciprocable member.

6. In a fountain pen, the combination with a barrel having a tapered seat therein and serving as an ink reservoir, filling mechanism which includes a sleeve member having an outer seat portion tapered complementally to said wall seat, a

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- flexible member adapted to close one end portion of said barrel and having a circular edge part supported upon the tapered seat of said sleeve, another sleeve member threadedly engaged with said barrel outwardly beyond said first sleeve and adapted as it is screwed into the barrel to engage said first sleeve and move it axially to secure the circular edge of said flexible member between said tapered seats in seal tight fashion, a reciprocable member slidably supported by both said sleeve members for flexing said flexible member, said reciprocable member having an operating part projected beyond said second sleeve member, longitudinal opposed slots in said reciprocable member, a cross member carried by said first sleeve member, and passing through said slots to limit reciprocation of said reciprocable member, and pockets in said reciprocable member at one end of said slots and connected to said slots to one side thereof for reception of said cross member upon rotation of said reciprocable member to lock the latter against reciprocation.
7. In a fountain pen, the combination with a barrel providing an ink reservoir, of filling mechanism which comprises a flexible member, a reciprocable member connected to said flexible member for flexing the latter to vary the air pressure in said barrel reservoir, a sleeve member supporting said flexible member and having wedge engagement with the wall of said barrel reservoir, another sleeve member having threaded engagement with said barrel and adapted to wedge-engage said first sleeve member with the barrel, an externally threaded extension on said second sleeve projecting beyond the one end of said barrel, said extension and first sleeve member serving as guides for said reciprocating member, the latter having an operating part projecting beyond said extension outside said barrel, and a cap member detachably threaded on said extension to conceal the latter and the operating part of said reciprocable member.
8. A self-contained filling mechanism adapted to be inserted in one end of the barrel of a fountain pen which comprises a flexible member for closing one end of said barrel, a support for said member, a reciprocable member connected to said flexible member and projecting from said one end of the barrel where it is accessible for operation, said support also serving to guide said reciprocable member, a separate sleeve member screw-threadedly mounted in said one end of said barrel for securing said support and flexible member in said barrel, said sleeve member having an externally threaded extension projecting beyond said one end of the barrel and serving as an additional guide for said reciprocable member, and a cap member detachably engageable with said extension to conceal said extension and the projecting end of said reciprocable member.
9. A filling mechanism for a fountain pen which may be inserted in and removed from the barrel of a fountain pen without detachment of the parts thereof relative to each other, which comprises a flexible member spanning the barrel to close an end portion thereof and having a circular edge portion adapted to be fixed relative to the barrel wall, a sleeve member supporting said edge portion and adapted to fix said edge portion in position upon the barrel wall, a reciprocable member engaged with said flexible member and guidingly-supported by said sleeve member, another sleeve member adapted for threaded engagement with the barrel and adapted to engage and move said first sleeve member and flexible member into their barrel closing positions, said second sleeve member also receiving said reciprocable member for guidance of the latter, means between said first sleeve member and reciprocable member for limiting movement of said reciprocable member, and a finger-operated device on said reciprocable member of greater dimensions than the bore of said second sleeve.
10. A unitary filling unit for a fountain pen adapted for insertion in and removal from the barrel of the pen without separation of parts, which includes a sleeve member adapted to be operatively associated with a fountain pen barrel by axial movement, a second sleeve member adapted to be screwed into the barrel and adapted as it is screwed into the barrel to engage and move said first sleeve member axially into its operative position, a flexible member adapted to close one end portion of the barrel and having a circular edge supported by said first sleeve member and adapted to be moved into operative sealed relation with respect to the barrel by axial movement of said first sleeve member, a reciprocable member supported by both said sleeve members and connected to said flexible member to flex the latter to vary the air pressure in the barrel, said reciprocable member having an exposed operating part, means for limiting movement of said reciprocable member, and means cooperating with said limiting means for locking said reciprocable member against movement at one end of its reciprocating movement.
11. In a fountain pen, the combination with a barrel providing an ink reservoir, filling mechanism which includes a flexible member closing one end portion of the barrel, a support means for said flexible member, a reciprocable member guidingly-supported by said support means and attached to said flexible member for flexing the latter to vary the air pressure in the barrel, means preventing rotation of said reciprocable member and limiting the extent of its reciprocating movement, means permitting rotation of said reciprocable member at one end of its reciprocatory movement and for locking said reciprocable member against reciprocatory movement upon rotation thereof, and a cap member carried by said support means and concealing the latter and said reciprocable member.
12. In a fountain pen, the combination with a barrel providing an ink reservoir, filling mechanism which includes a flexible member closing one end portion of the barrel, a support means for said flexible member, a reciprocable member guidingly-supported by said support means and attached to said flexible member for flexing the latter to vary the air pressure in the barrel, said reciprocable member having an operating part projecting from the barrel, a connection between said support means and said reciprocable member permitting reciprocation only of the latter for the greater part of its length and permitting rotation thereof at one end of its reciprocatory movement to lock said reciprocable member against reciprocatory movement, and a cap member adapted to cover and conceal the operating part of said reciprocable member in the locked position of the latter.
13. In a fountain pen, the combination with a barrel providing an ink reservoir, of a filling mechanism including a tubular flexible member having a closed end and an open end, a head on the closed end of said tubular member and having an external annular groove therein, a member supporting the open end of said tubular

member and for seal-engaging it with the barrel to close one end portion of the latter, another tubular and reciprocable member having one end open, and intumed to engage in said head groove to receive a part of said head within said reciprocable member, means in said reciprocable member engaging said head therein and locking said head thereto, a sleeve member threaded into the end of said barrel to lock said support member in operative position therein, said support and sleeve members guiding said reciprocable member for movement to flex said flexible member and vary the air pressure in the barrel.

14. In a fountain pen, the combination with a barrel having an open end, of filling mechanism insertable in said open end and including a flexible sealing member for closing said open end of the barrel, a member supporting said sealing member and securing the same to the barrel in sealed fashion, a reciprocable member guided by the support member for flexing said flexible member, a lock member having screw threaded engagement with said open end portion of the barrel and securing said support member in place as well as affording additional guidance for said reciprocable member, and means between said support and reciprocable member locking the latter against reciprocation at one end of its reciprocation movement.

15. In a fountain pen, the combination with a barrel having an open end, of filling mechanism insertable in said open end and including a flexible sealing member for closing said open end of the barrel, a member supporting said sealing member and securing the same to the barrel in

sealed fashion, a reciprocable member guided by the support member for flexing said flexible member, a lock member having screw threaded engagement with said open end portion of the barrel and securing said support member in place as well as affording additional guidance for said reciprocable member, means limiting the reciprocation movement of said reciprocable member, and locking means in said reciprocable member cooperating with said limiting means for locking said reciprocable member against reciprocation.

16. In a fountain pen, the combination with a barrel having an open end, of filling mechanism insertable in said barrel end which includes a flexible sealing member closing said open end of the barrel, a reciprocable member for flexing said sealing member to vary the pressure in said barrel, a sleeve-like member supporting and securing said flexible member in said barrel and guiding said reciprocable member, said reciprocable member having opposed longitudinal slots extending throughout a substantial part of its length and having circumferentially offset pockets at and connected to the corresponding ends of said slots, a cross member carried by said sleeve-like member and passing through said slots to limit reciprocatory movement of said reciprocative member and to prevent rotation thereof during its reciprocation, said pockets permitting rotation of said reciprocable member to receive said cross member in said pockets and prevent further operative reciprocation of said reciprocable member.

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