July 2, 1946. M. S. BAKER 2,403,039

FOUNTAIN PEN

Filed Sept. 18, 1944

Fig. 1.

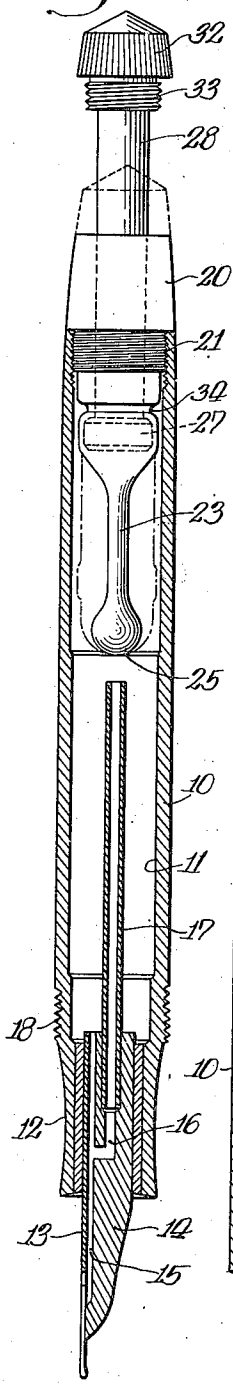


Fig. 2.

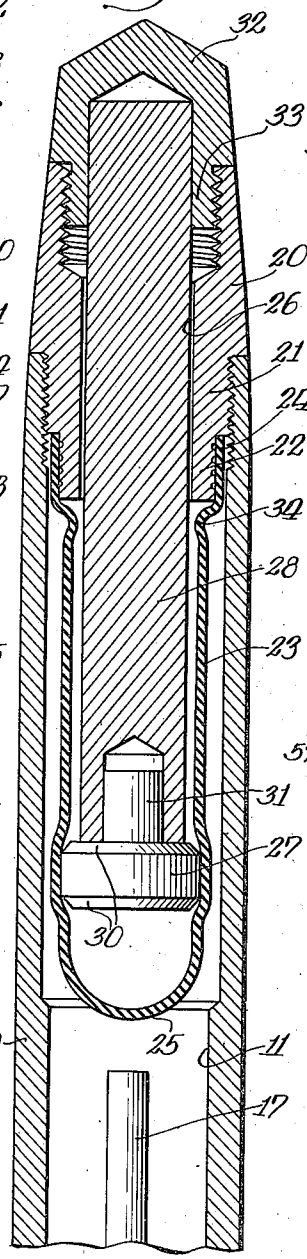


Fig. 3.

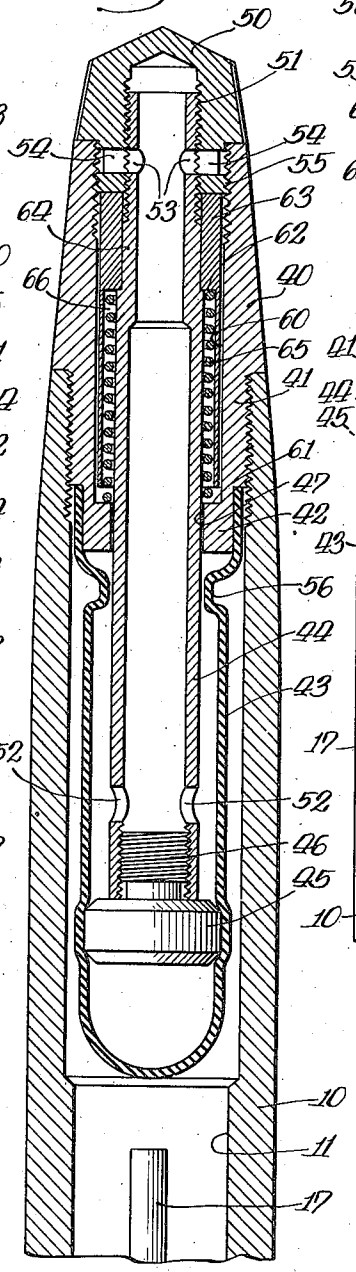
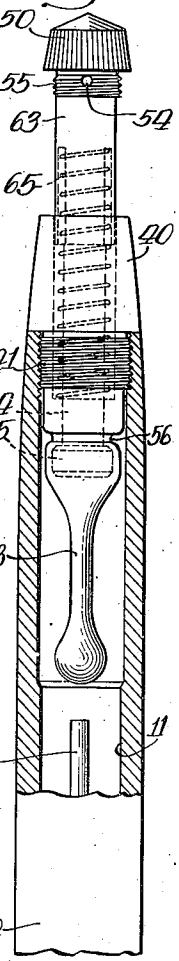


Fig. 4.



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FOUNTAIN PEN

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10 Claims. (Cl. 120—47)

1

The invention relates generally to filling devices for fountain pens and more particularly to a multiple stroke filling device of the type disclosed in the Dahlberg Patent No. 1,904,358.

The general object of the invention is to provide a novel filling device of the foregoing character, which is of simple and inexpensive construction, which may be readily operated, and which provides a substantial reduction in the effective volume of the barrel or reservoir of the pen during the filling operation so that a substantial quantity of ink may be drawn in on each stroke of the device.

It is also an object to provide a novel filling device of the multiple stroke type, which is of inexpensive construction resistant to wear and deterioration to provide a long life, and is highly effective in its pumping action.

Another object is to provide a novel filling device of the multiple stroke type, having a bulbous type diaphragm adapted alternately to be collapsed by a decrease in air pressure therein effected by movement of a part in one direction therein and to be physically expanded by movement of said part in the opposite direction.

A further object is to provide a novel filling device of the multiple stroke type, having a bulbous type diaphragm adapted to be alternately collapsed and expanded by a part reciprocable within and relative to the diaphragm and having a sealing relation therewith, the reciprocation of said part alternately reducing the air pressure in the diaphragm to effect collapse thereof and expanding the diaphragm physically.

Still another object is to provide a novel filling device of a self-contained unitary structure, which may be constructed for actuation of the movable part thereof by manual operation for both directions of movement or with a spring tending to move such part in one direction.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view of a fountain pen provided with a filling device embodying the features of the invention.

Fig. 2 is a fragmentary view of the pen on an enlarged scale and showing the filling device in section.

Fig. 3 is a view similar to Fig. 2 and showing another embodiment of the invention.

Fig. 4 is a view similar to Fig. 3 and showing the filling device of Fig. 3 with its parts in operating position.

2

For purposes of illustration, the two embodiments of the invention herein disclosed are shown secured to a fountain pen which, in the present instance, comprises a barrel 10 of generally cylindrical form and having an internal ink receiving chamber or reservoir 11. At the forward end of the barrel is the usual pen section 12 which carries a pen point 13 and a feed bar 14 extending through the pen section. The feed bar 14 is provided with a feed channel 15 through which ink is fed from the reservoir 11 to the pen point 13. Branching off from the feed channel 15 intermediate its ends is an L-shaped passage 16 having secured therein a breather tube 17 of conventional form. The barrel may be provided with threads 18 at its lower end for reception of the usual cap or cover (not shown) to protect the point 13 when not in use.

A filling device embodying the features of invention is of the multiple stroke type operating in the manner disclosed in the above-mentioned Dahlberg patent and is mounted in the rear end of the barrel 10. A filling device of this character is constructed so that movement of its movable part in one direction decreases the effective volume of the reservoir 11 and thus discharges air therefrom through the breather tube 17, and movement in the opposite direction draws in an equivalent volume of ink, the point 13 of the pen of course being inserted in a container of ink during such operation. The amount of air discharged and ink drawn in on each stroke of the filling device is only a fraction of the total volume of the reservoir 11 so that, by a plurality of strokes of the filling device, sufficient ink will be drawn into the barrel to fill it to the desired level, such level being limited by the height of the breather tube 17.

A filling device embodying the features of the invention comprises generally a body structure adapted to be secured to the rear end of the barrel and having mounted thereon a diaphragm of elongated bulbous form when expanded and of generally flattened form but substantially unchanged in length when contracted. The diaphragm is made of suitable flexible material such as rubber and is so constructed that, when collapsed and in flattened form, it occupies a minimum of space within the barrel. To expand the diaphragm, a plunger is reciprocally carried by the body structure of the filling device and is provided with a head which expands the portion of the diaphragm lying between such head and the body structure. Thus, the major portion of the length of the diaphragm will be alternately

expanded and flattened to alternately decrease and enlarge the effective volume of the reservoir and thereby create a differential pressure within the reservoir which forces air therefrom and draws in ink.

In the embodiment shown in Figs. 1 and 2, the body structure of the filling device comprises a member 20 preferably dimensioned to form an extension of the barrel 10. The body member 20 is provided on its front end with a threaded portion 21 adapted to be screwed into the barrel 10 and terminating in a reduced portion 22 extending into the barrel and having a diameter substantially less than the internal diameter of the barrel.

Secured to the body member is an elongated generally bulbous diaphragm 23 having an open end 24 and a closed end 25. The open end 24 is sleeved over the reduced portion 22 of the body structure and is secured thereto as by cement. The diameter of the reduced portion 22 is such that the open end 24 of the diaphragm clears the barrel 10, and the filling device thus may be readily removed from the barrel for purposes of repair merely by unscrewing the threaded portion 21 from the barrel.

The diaphragm 23 is so constructed that it assumes a flattened form, when collapsed, without any substantial change in length, as shown in Fig. 1. It thus occupies a minimum of space within the barrel. Such collapsing of the diaphragm is effected by means of a plunger, indicated at 25, reciprocably supported in a bore 26 of the body member 20. The plunger 25 extends into the diaphragm 23 and at its lower or inner end is provided with a head 27 serving as a piston within the diaphragm. The head 27 is of such diameter that it creates a vacuum within the portion of the diaphragm between the head and the closed end of the diaphragm to cause it to collapse pneumatically, and expands the portion between the head and the body portion. Hence, by reciprocation of the head 27 within the diaphragm the major portion thereof may be alternately expanded to its bulbous form and contracted to its flattened form. In order to facilitate molding of the diaphragm and to prevent any sharp flexure thereof during operation, the lower or closed end 25 is shaped to remain substantially in its expanded form throughout the operation of the device.

The head 27 is bevelled at its two faces, as shown at 30, to facilitate the sliding movement thereof within the diaphragm 23, and is provided with a stem 31 extending into a bore in the end of the plunger 25 and cemented therein to rigidly secure the head to the plunger. Since the portion of the diaphragm 23 beyond or forwardly of the head 27 would not contract to its flattened form if air were permitted to gain access thereto during reciprocation of the plunger, the head 27 is of such diameter as to distend the diaphragm slightly beyond its normal expanded diameter. Thus, the diaphragm hugs tightly about the head 27 and provides a seal preventing access of air into the forward end of the diaphragm.

Reciprocation of the plunger within the diaphragm would of course create changes in pressure within that portion of the diaphragm lying between the head 27 and the body structure unless the interior of such space were vented to the outside atmosphere. Thus, on a down stroke of the plunger, a partial vacuum would be created within such space in the diaphragm, which would tend to cause the diaphragm to hug the plunger and thus decrease the amount of expansion of

the diaphragm. On the upward stroke of the plunger, without such venting, a pressure would be built up within such space, which would tends to force air around the head 27 and into the lower or forward end of the diaphragm. Since the seal between the head and the diaphragm cannot be particularly tight in view of the fact that the head has to reciprocate easily within the diaphragm, any building up of pressure in the space above the head might break such seal. However, such space can be readily vented to the outside atmosphere by so dimensioning the bore 26 in the body member 20 and the plunger 25 that the latter has a loose fit within the bore. Air may thus pass between the body member and the plunger to maintain the pressure within the upper portion of the diaphragm substantially equal to the outside atmosphere. The collapsing of the diaphragm, as explained above, is due to the creation of a vacuum therein, while the admission of air between the body member and plunger to the interior space above the head 27 permits the diaphragm to expand to its normal, bulbous form. The collapsing and expanding of the diaphragm may therefore be said to be effected pneumatically, since such actions are dependent upon air pressures.

The upper or open end of the diaphragm, it will be noted, is expanded to fit tightly over the reduced portion 22 of the body member. With such expansion, the sealing action of the diaphragm about the head 27 would not be as effective, when the head is in its upper position, as when the head is farther down in the diaphragm. Moreover, in operating the device, the head may remain in its upper position for a moment before the user again pushes it downwardly, and, with a less effective seal, there might be some chance of air leaking into the front or lower portion of the diaphragm around the head. To prevent such a leak occurring, the diaphragm is provided with a restricted neck 34 adjacent the end of the reduced portion 22, which holds the diaphragm tightly about the head 27 when in its upper position. The diaphragm may thus be collapsed to its flattened form for substantially its full length without the chance of air leaking around the head.

It is, of course, desirable to lock the plunger 25 in a fixed position when the filling device is not being used. To this end, a cap 32 is mounted on the upper end of the plunger 25, the two being preferably cemented together to provide a semi-permanent attachment. The cap is provided with a threaded portion 33 adapted to be screwed into the upper or outer end of the body member 20 and thus retain the parts in fixed relation. Preferably the cap 32 is dimensioned to constitute a continuation or extension of the body member 20, and since the latter is likewise dimensioned to constitute an extension of the barrel, the cap and body member provide a neat uniform appearance when the device is mounted on the barrel.

Movement of the plunger 25 in both directions in this embodiment is effected manually, the cap 32 providing a part which may be readily grasped when unscrewed from the body member 20 to effect such reciprocation. The device is of a self-contained unitary character since the diaphragm is secured to the body member 20 and the other parts are assembled in proper relation thereto, independently of the means by which the body member is secured to the barrel. Thus, in case of replacement, the whole device may be

removed from the barrel merely by unscrewing the body member therefrom.

The embodiment shown in Figs. 3 and 4 is generally similar to that shown in Figs. 1 and 2 but differs chiefly in that a spring is provided for effecting movement of the plunger in one direction. In this embodiment, the body member, indicated at 40, is provided with a threaded portion 41 adapted to be screwed into the rear end of the barrel 10. On the front or lower end of the body member is a reduced portion 42 adapted to receive the open end of a bulbous type diaphragm 43 similar in construction to the diaphragm shown in the other form. The diaphragm 43 is adapted alternately to be expanded to a bulbous form and to contract to a flattened form by the reciprocation of a plunger 44. The latter is provided with a head 45, and in the present instance, the plunger 44 is tubular, and the head 45 is provided with a threaded stem 46 screwed into the lower end of the plunger 44.

The plunger 44 is reciprocably supported in a bore 47 in the body member 40 and extends upwardly therebeyond to be secured to a cap 50 at its upper end. In the present instance the cap 50 is secured to the plunger by being threaded thereon as indicated at 51.

Venting of the space within the diaphragm 43 between the head 45 and the reduced portion 42 is accomplished in the present instance by utilizing the interior of the tubular plunger 44. To this end, transverse openings 52 are provided in the lower end of the plunger 44 immediately above the threaded stem 46 of the head 45 to connect such space with the interior of the plunger. At its upper end, the plunger is provided with transverse apertures 53 registering with apertures 54 provided in a threaded stem 55 extending from the inner face of the cap 50. The threaded stem 55 is adapted to be screwed into the end of the body member 40 to secure the parts of the device in fixed position when not in use. Thus when the cap 50 is unscrewed from the end of the body member 40, the space within the diaphragm 43 is freely vented through the transverse apertures 52, the interior of the plunger 44, and the apertures 53 and 54 at the upper end of the plunger. Since the apertures 52 are located above the stem 46 of the head 45, such apertures when the plunger is in its upward or extended position, will be located within the bore 47 of the body member and thus be substantially closed off for a short portion of the reciprocation of the plunger. While no great pressure could be built up within the space within the diaphragm for the short period during which the apertures 52 are covered, means is provided to definitely insure that no air will be forced into the lower end of the diaphragm due to such slight pressure as might be created at this time. To this end, the diaphragm adjacent the reduced portion 42 of the body member is provided with a restricted neck 56 which seats against and provides a seal with the head 45 of the plunger so that no air can be forced around the head.

One of the features of this embodiment of the invention is the provision of a spring to effect movement of the plunger in one direction. To this end, the bore through the body member is enlarged as at 60 to provide a shoulder 61. Spaced from the shoulder 61 an oppositely facing shoulder 62 is provided by a sleeve 63 clamped on the reduced upper end 64 of the plunger by means of the cap 50. Interposed between the

shoulders 61 and 62 and surrounding the plunger is a coiled spring 65 which tends to force the plunger upwardly and thus permit the diaphragm to contract to its flattened form. Preferably the sleeve 63 is provided with an elongated shell portion 66 extending downwardly within the bore 60 and encasing the spring 65 to serve as a guide therefor.

In the operation of the filling device shown in Figs. 3 and 4, when the cap 50 is unscrewed from the end of the body member 40, the spring 65 causes the plunger to move upwardly and thus move the head 45 to a position adjacent the body member, causing the major portion of the diaphragm to collapse, due to a decrease in air pressure therein, into its flattened form without any substantial change of length, as shown in Fig. 4. Manual depression of the plunger moves the head 45 downwardly therein and thereby expands that portion of the diaphragm lying between the head and the body member. Thus, by alternate contraction and expansion of the diaphragm, the desired differential pressure within the barrel may be effected to fill the pen. The space within the diaphragm between the head 45 and the body member is freely vented to the outside atmosphere through the transverse apertures 52, the interior of the plunger, and the apertures 53 and 54 at the upper end. Any slight pressure that may be built up within this space when the plunger is at the upper end of the structure and the apertures 52 lie within the body member is prevented from causing air to pass around the head 45 by the seal effected by the restricted neck 56 bearing against the top face of the head 45. As in the case of the other embodiment, the body member 40 and the cap 50 constitute extensions of the barrel 10 and present a neat continuous appearance when the parts are locked in place, and because of the unitary construction of the device, the device as a whole may be removed from the barrel merely by unscrewing the threaded portion 41 therefrom.

I claim:

1. A filling device for a fountain pen comprising a body structure, a diaphragm secured at one end to said body structure and closed at its other end, and a plunger extending through and reciprocably supported by said body structure and having a head located within said diaphragm, said diaphragm being held by said head in an expanded bulbous form between said head and the body structure and being pneumatically caused to assume a flattened form beyond said head, said head being slightly larger in diameter than the normal expanded diameter of said diaphragm to distend the diaphragm about said head and thereby provide a seal to prevent air from being forced around said head and into the portion of the diaphragm beyond said head.

2. A filling device for a fountain pen comprising a body structure, a diaphragm secured at one end to said body structure and closed at its other end, and a plunger extending through and reciprocably supported by said body structure and having a head located within said diaphragm, the portion of said diaphragm between said head and said body structure being held by said head in an expanded bulbous form and the portion of said diaphragm beyond said head being caused to assume a flattened form by decreased air pressure therein, said head being dimensioned to distend the diaphragm about said head to provide a seal preventing air from being forced around said head from the first-mentioned portion and into the

second-mentioned portion, said first-mentioned portion being vented to the outside atmosphere.

3. A filling device for a fountain pen comprising a body structure, a diaphragm secured to said body structure, and a plunger carried by said body structure and having a head reciprocable within the diaphragm to expand the portion thereof between said head and said body structure into bulbous form and to decrease the air pressure within the portion beyond said head to effect flattening thereof, said diaphragm having a restricted neck adjacent said body structure adapted to engage the said head when the diaphragm is fully collapsed to provide a seal to prevent access of air around said head to the flattened portion of the diaphragm.

4. A filling device for a fountain pen comprising a body member having a portion secured to the end of the barrel of the pen and a reduced portion extending into the barrel, a diaphragm having one end sleeved over said reduced portion and its other end closed, a plunger extending through and reciprocably supported by said body member and having one end adapted to expand said diaphragm into bulbous form and to effect contraction thereof, and a cap secured to the other end of said plunger and adapted to be removably secured to said body member to hold said plunger idle.

5. In a fountain pen having a barrel, a filling device comprising a body member having a threaded portion screwed into the end of the barrel and a reduced portion extending into the barrel, a diaphragm having a closed end and an open end, the open end being sleeved over said reduced portion, a plunger extending through and reciprocably supported by said body member and having a head on one end located within the diaphragm and adapted to expand the diaphragm into bulbous form, and a cap secured to the other end of said plunger and having a threaded portion adapted to be screwed into said body member to releasably hold said plunger idle.

6. In a fountain pen having a barrel, a filling device comprising a body member adapted to be secured to the end of the barrel and constituting an extension thereof, a diaphragm within the barrel having a closed end and an open end with the latter secured to said body member, a plunger extending through and reciprocably supported by said body member and having one end extending into said diaphragm and adapted to expand said diaphragm into bulbous form, and a cap secured to the other end of said plunger and adapted to be removably secured to said body member to hold said plunger idle, said cap when so secured constituting an extension of said body member.

7. A filling device for a fountain pen comprising a body member adapted to be secured to the pen, a diaphragm secured to one end of said body member, and a tubular plunger reciprocably mounted in said body member and having a head at one end located within said diaphragm and adapted to expand said diaphragm into bulbous form, said plunger having an opening connecting the interior of the plunger with the space within said diaphragm between said head and said body member to provide a vent to the outside atmosphere.

8. A filling device for a fountain pen comprising a body member adapted to be secured to the pen, a diaphragm secured to one end of said body member, and a tubular plunger reciprocably mounted in said body member and having a head at one end located within said diaphragm and adapted to expand said diaphragm into bulbous form, said head closing one end of the interior of said plunger, and a cap secured to the other end of said plunger, said plunger having lateral openings respectively adjacent said head and said cap connecting the space within said diaphragm between said head and said body member with the outside atmosphere through the interior of said plunger.

9. A filling device for a fountain pen comprising a body member adapted to be secured to the pen and having an internal bore provided with an internal shoulder, a diaphragm secured to one end of said body member, a plunger reciprocably mounted in said body member and having a head at one end located within said diaphragm and adapted to expand the portion of said diaphragm between said head and said body member into bulbous form and to effect contraction of the portion of the diaphragm beyond said head, said plunger being provided with a shoulder facing said internal shoulder, and a coiled spring surrounding said plunger and bearing against said shoulders to urge said head toward said body member.

10. A filling device for a fountain pen comprising a body member adapted to be secured to the pen and having an internal bore provided with an internal shoulder, a diaphragm secured to one end of said body member, a plunger reciprocably mounted in said body member and having a head at one end located within said diaphragm and adapted to expand the portion of said diaphragm between said head and said body member into bulbous form, a cap secured to the other end of said plunger, a sleeve member located within said bore and secured to said plunger by said cap, and a coiled spring surrounding said plunger and bearing against said shoulder and said sleeve member and encased by the latter, said spring tending to move said head toward said body member.

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