

PATENT SPECIFICATION

318,982

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COMPLETE SPECIFICATION.

Improvements in or relating to Fountain Pens.

I, ARTHUR OLANS DAHLBERG, a citizen of the United States of America, of 145, Iota Court, Madison, State of Wisconsin, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

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

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 with 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.

In accordance with the present invention, the improved fountain pen has writing means at one end of a barrel which is closed at the other end by a flexible sealing member having means for manipulating its central portion to deform the sealing member for filling the barrel.

[Price 1s.]

The foregoing and other features are hereinafter referred to and embodiments of the invention will now be described with reference 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; and

Fig. 10 is a similar view of the filling device shown in Fig. 9, with the parts thereof shown in operated 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 a type which is well known in the art.

The upper end of the barrel 12 is closed by a pliable sealing member or flexible

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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 annular shoulder 38 and the cooperating ring portion 40 are tapered so that the peripheral edge portion of the diaphragm is secured at an angle of less than ninety degrees with the remaining portion of the diaphragm when the plunger is at the upper end of its stroke.

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 tube 24, duct 22 and groove 20 much more rapidly than ink is ejected from the groove 21, 20. 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

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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 greater 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, manipulation 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. For this purpose the greatest external diameter of the diaphragm 26 fitted over the end of the sleeve 42 is slightly less than the least diameter of the portion adjacent the upper end of the barrel 12, and the plunger 36, guided in the sleeve 42, is removable with the sleeve and the diaphragm. 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 herein-after point out and particularly describe only 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 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 shoulder 126 which also serves as a limiting 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 cap 130 in this construction, as well as in the modifications previously described, is adapted to make a quick detachable connection with the threaded sleeve 124.

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.

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 scope of the invention, and I, therefore, do not wish to limit myself to these particular embodiments of my invention except by the terms of the appended claims.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed. I declare that what I claim is:—

1. A fountain pen having writing means at one end of a barrel which is closed at the other end by a flexible sealing member having means for manipulating its central portion to deform said sealing member for filling said barrel.

2. A fountain pen according to claim 1, wherein the sealing member has its peripheral edge fixed relative to said barrel.

3. A fountain pen according to claim 1 or 2, wherein said sealing member is a normally conically-shaped element whose edge is clamped, by means such as a ring or sleeve, against the inner wall of said barrel.

4. A fountain pen according to claim 3 wherein said sealing member is carried by said sleeve which is secured in the end of said barrel.

5. A fountain pen according to claim 3 or 4, wherein said sleeve is arranged to carry manipulative means slidable from normal position to deform said flexible sealing member.

6. A fountain pen according to claim 5, wherein said sealing member and manipulative means are returned to normal position by resilient means such as a spring.

7. A fountain pen according to any of the preceding claims, wherein said sealing member, which is substantially conical in shape when in its innermost position and has a re-entrant central portion secured to the manipulative means,

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- such as a plunger, is so shaped and proportioned that upon outward movement of its central portion it will roll freely upon itself, turn inside out and assume a substantially inverted conical shape.
8. A fountain pen according to claim 6 and 7, wherein said manipulative means move the central portion of said sealing member inwardly and said resilient means move the central portion of said sealing member outwardly so as to vary the pressure within the barrel.
9. A fountain pen according to any of the preceding claims 5 to 8, wherein said manipulative means protrude from said barrel for access for manual operation for reciprocating a portion of said sealing member to create differential pressures in said barrel.
10. A fountain pen according to any of preceding claims 5 to 9, wherein means are provided for guiding and limiting the reciprocating movement of said manipulative means or plunger.
11. A fountain pen according to any of the preceding claims, wherein said barrel adjacent one end of its inner wall has a tapered portion with which said sealing member is held in engagement by means of a tapered ring or sleeve.
12. A fountain pen according to any of the preceding claims 5 to 11, wherein the greatest external diameter of said sealing member, fitted over the end of said ring or sleeve, is slightly less than the least diameter of the portion adjacent the upper end of said barrel, whereby said sleeve and sealing member may easily be removed from said barrel as a unit, said manipulative means being guided in said sleeve and removable therewith.
13. A fountain pen according to any of the preceding claims, wherein said sealing member encircles a sleeve-like plug which is threaded in the upper end of said barrel and guides the reciprocable plunger.
14. A fountain pen according to any of the preceding claims, wherein means are provided for securing the peripheral edge portion of said sealing member at an angle of less than ninety degrees with the remaining portion of said sealing member when the plunger is at one end of its stroke.
15. A fountain pen according to any of the preceding claims 5 to 14, wherein a cap is rotatably secured to said manipulative means.
16. A fountain pen according to claims 4 and 15, wherein the cap has a threaded bore cooperable with a threaded end of said sleeve.
17. A fountain pen according to claim 15 or 16, wherein said cap has an internally threaded portion adapted to be screwed over threaded portions on the plunger.
18. A fountain pen according to claim 15 or 16, wherein said cap is secured to the plunger by an undercut annular groove which is adapted to receive an outwardly projecting flange at the outer end of said plunger.
19. A fountain pen according to claim 10, wherein a pin is diametrically mounted in the sleeve and passes through slots in the plunger so as to limit the movement of said plunger.
20. A fountain pen according to claim 19, wherein a resilient means, such as a spring, reacts between said pin and plunger.
21. A fountain pen according to claim 20, wherein said plunger is manually operable in one direction by a cap or stem and is moved in the opposite direction by said spring.
22. A fountain pen according to any of the preceding claims 4 to 14, wherein a cap is adapted to make a quick detachable connection with said sleeve.
23. A fountain pen according to claims 6 and 10, wherein the means provided for guiding said plunger also engage the central portion of said sealing member and one end of the spring.
24. A fountain pen according to any of the preceding claims 7 to 14 or 19 to 22, wherein the sleeve and plunger have inter-engaging wedging surfaces for fixing said plunger in said sleeve.
25. A fountain pen according to any of the preceding claims wherein the barrel serves as the ink reservoir.
26. A fountain pen substantially as described with reference to the accompanying drawings.

Dated the 22nd day of November, 1928.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

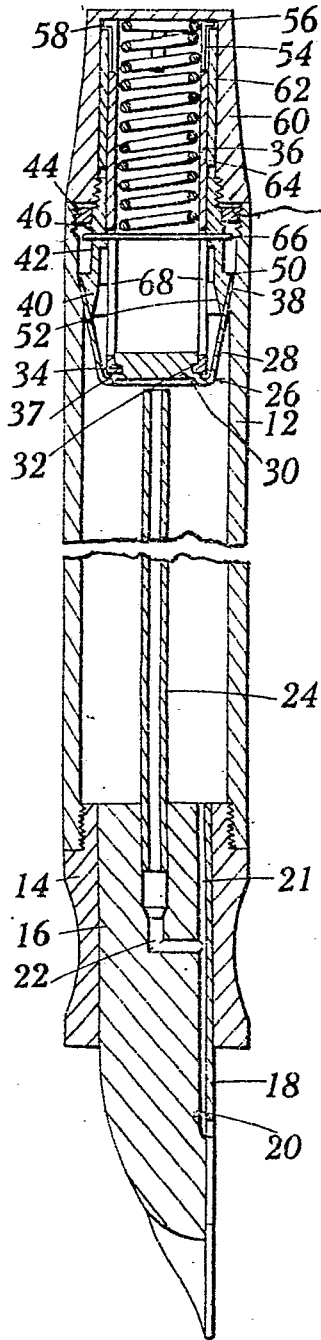


Fig. 2.

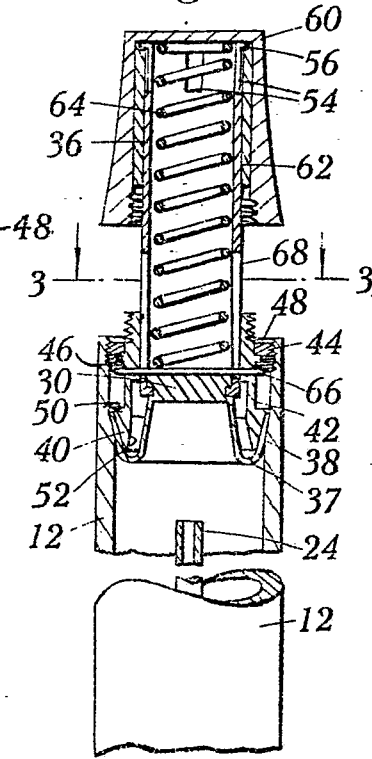


Fig. 3.

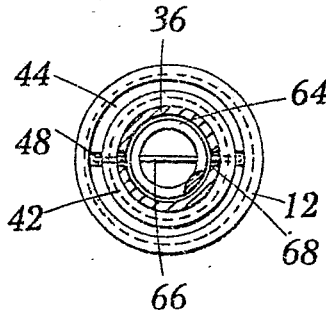


Fig. 4.

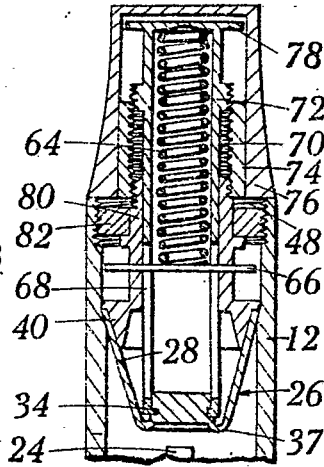
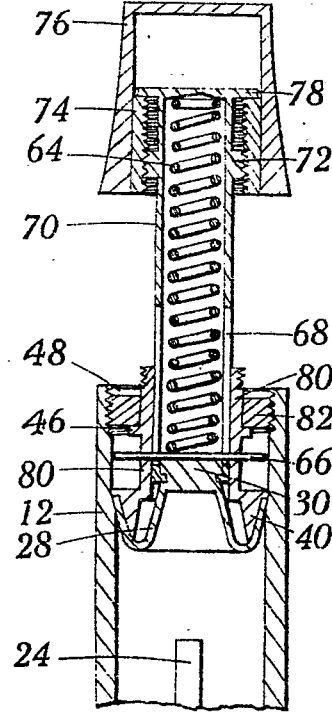


Fig. 5.



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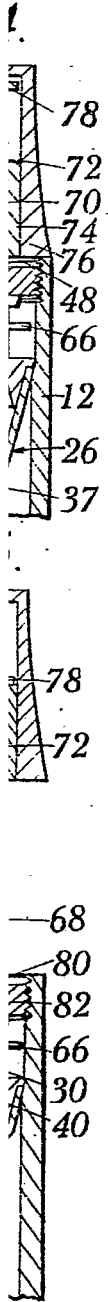


Fig. 9.

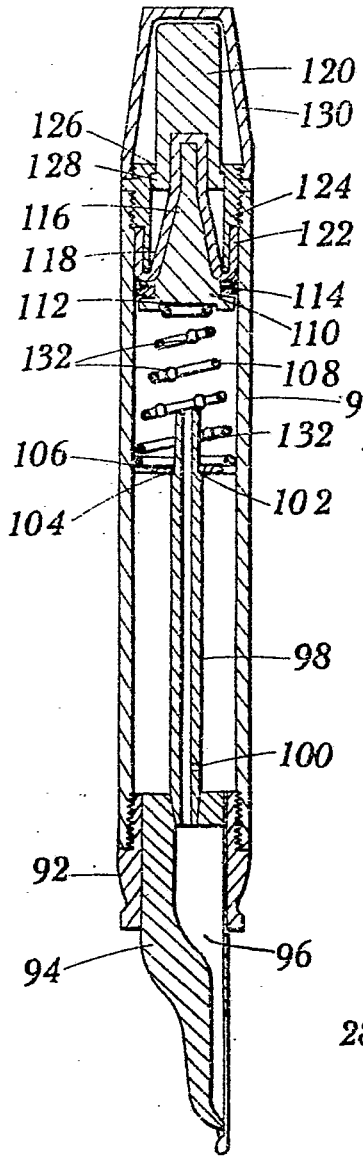


Fig. 10.

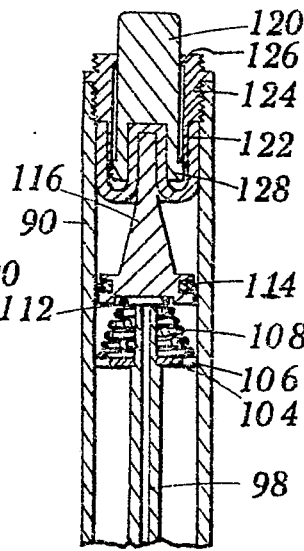


Fig. 7.

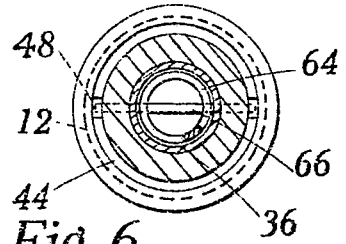


Fig. 6.

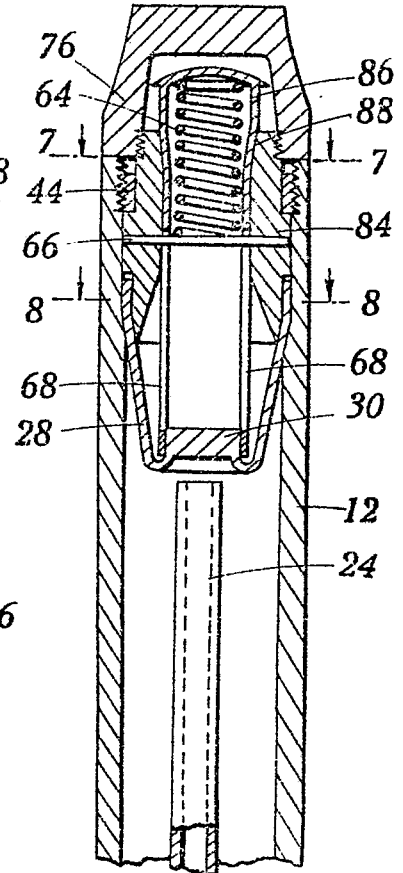
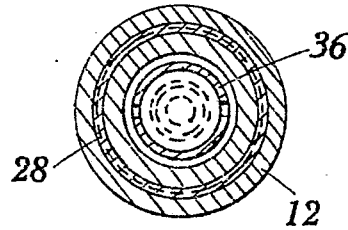


Fig. 8.



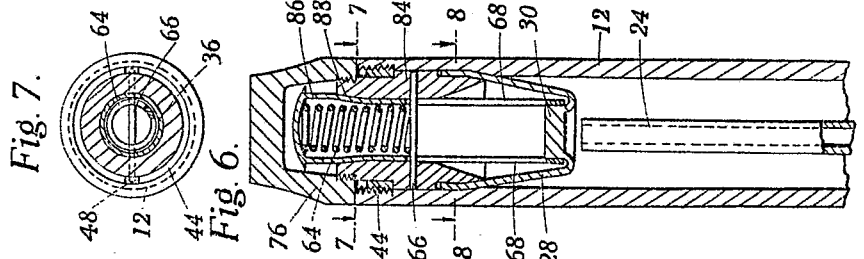
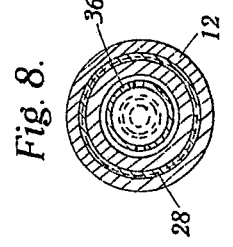
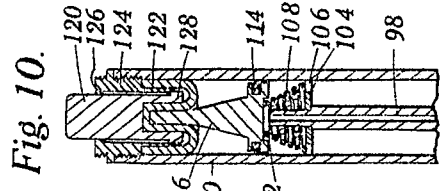
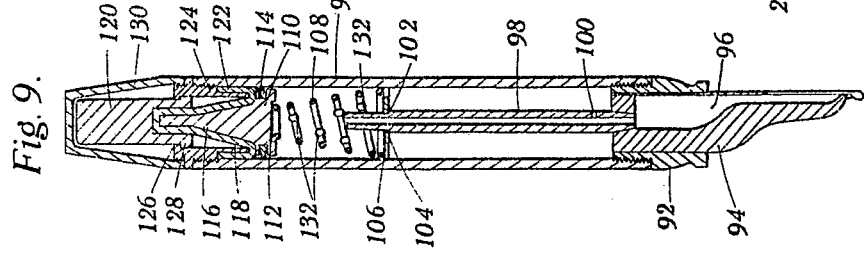
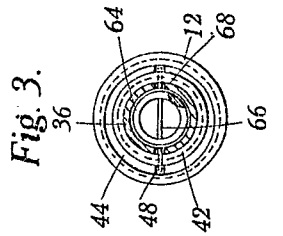
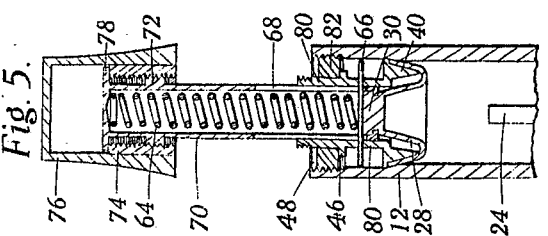
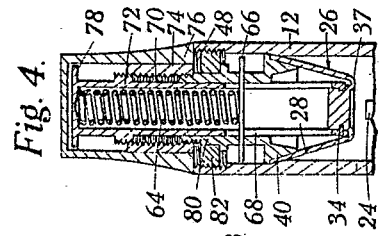
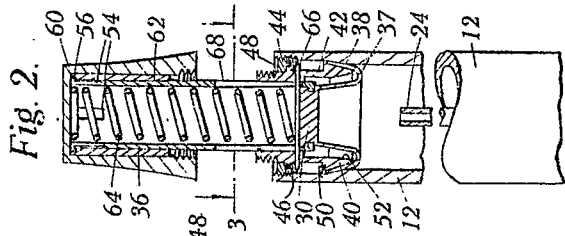
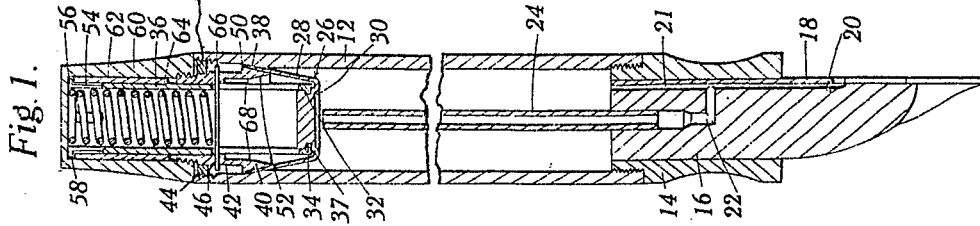


Fig. 7.

Fig. 6.

Fig. 10.

Fig. 8.

Fig. 9.

Fig. 4.

Fig. 5.

Fig. 2.

Fig. 3.

Fig. 1.

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