May 19, 1936. L. A. KELLEY 2,040,999

FOUNTAIN PEN

Filed May 27, 1935

FIG. 1.

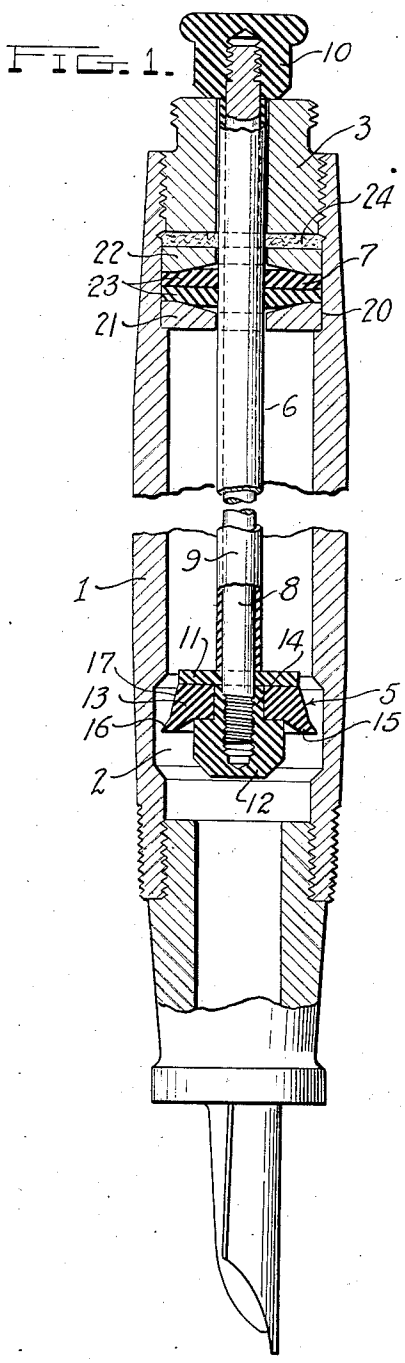


FIG. 2.

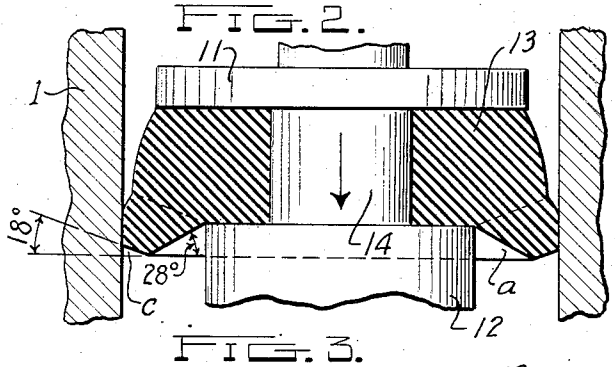


FIG. 3.

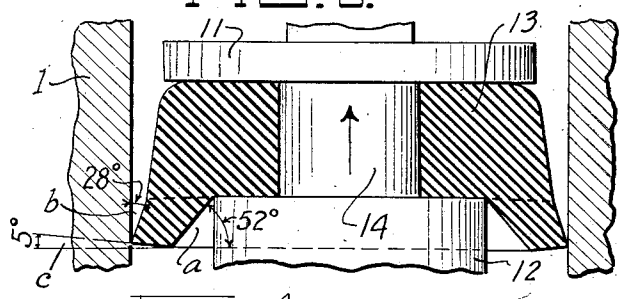


FIG. 4.

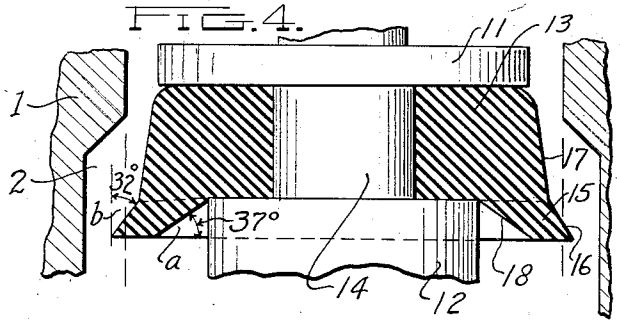
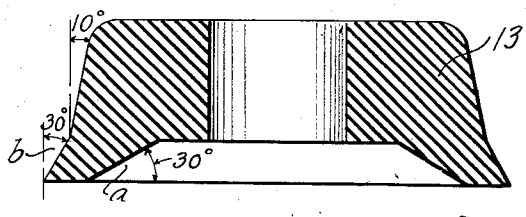


FIG. 5.



Inventor
Lloyd A. Kelley

By Owen & Owen,

Attorneys.

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UNITED STATES PATENT OFFICE

2,040,999

FOUNTAIN PEN

Lloyd A. Kelley, Toledo, Ohio, assignor to The Conklin Pen Company, Toledo, Ohio, a corporation of Ohio

Application May 27, 1935, Serial No. 23,588

5 Claims. (Cl. 120—47)

This invention relates primarily to fountain pens, and particularly to those of the type employing a plunger reciprocally movable in the pen barrel and operable to effect a filling of the barrel with ink.

In the use of such pen barrel filling means, it is common to have the plunger, on its rear stroke, act more or less freely in the barrel to permit air to escape therearound as it is displaced thereby, and then, on its forward stroke, to create a vacuum in the barrel at the rear of the plunger, and finally, when at the forward end of its stroke, to enter a portion of the barrel which places the vacuum space in communication with the open pen-carrying end of the barrel to effect a drawing of ink into such space with the open barrel end immersed in ink. One feature of the invention relates to improvements in the plunger to facilitate its operation and smoothness of action in the barrel.

The invention is fully described in the following specification, and one embodiment thereof illustrated in the accompanying drawing, in which—

Figure 1 is a central longitudinal section of a fountain pen embodying the invention with parts broken away and parts in full, and with the cap at the rear end of the barrel removed; Figs. 2, 3 and 4 are enlarged fragmentary details of the pen showing the cup member of the plunger in section and illustrating the form of such member at various positions in the barrel and under different conditions, and Fig. 5 is a central sectional view of the cup member free from the plunger and in normal form.

Referring to the drawing, 1 designates the hollow ink carrying barrel of a fountain pen, the pen end of which is open to permit the admission of ink thereto when filling and its feeding discharged therefrom to the writing point when writing, as well as understood in the art. The interior of the barrel near its open end is provided with an enlargement 2, the purpose of which is hereinafter explained. The opposite end of the barrel is closed in any suitable manner as by a plug 3 threaded therein.

For the purpose of filling, a plunger 5 is mounted in the barrel 1 for reciprocatory movements therein and is carried by a stem 6 that projects without the closed end of the barrel through a central aperture in the plug 3 and through a packing unit 7 at the inner end of such plug. The stem 6, in the present instance, comprises a metallic rod 8 and an enclosing sleeve or tubular covering 9 of a suitable material, such as hard rubber, to withstand the corrosive action of writing fluids. The outer end of the stem is provided with a knob 10 to facilitate manual operating, such knob being threaded on the outer end of the rod 8 in abutment with the outer end of the sleeve 9. The stem 6 is of suitable length to position the plunger 5, when at the forward end of its stroke, in the barrel enlargement 2, so that both end portions of the barrel cavity are in communication around the plunger through said enlargement.

The plunger 5 comprises a backing plate 11, a clamping member 12 and a yielding cup member 13 clamped therebetween. The stem rod 8 projects through a central aperture in the backing plate 11 and threads into the clamping member 12 and the latter has a reduced extension 14 at its inner end which projects through a central aperture in the cup member 13 and abuts at its free end against the backing plate 11, thus limiting the extent of compression of the cup member 13 by a clamping action of the members 11 and 12. The plate 11 is of less diameter than the barrel cavity and has its outward thrust against the inner end of the stem sleeve 9, and the clamping member 12 is of less diameter than the plate 11, as shown. The members 11 and 12 are of hard rubber, or other suitable material, which is resistant to the corrosive action of writing fluids.

The cup member 13 is of yielding resilient material such as soft rubber and is compressed to some extent by the clamping action of the members 11 and 12. This cup member has a rather thick disk-form of body which, at its top, is substantially the same diameter as the backing plate 11, and has its outer peripheral wall preferably slightly tapered with its large end outermost. The member 13, at its lower marginal edge, is formed with a depending skirt 15 with its outer peripheral surface gradually enlarging on a taper 16 from its inner to its outer edge at a slight angle to the peripheral face 17 of the cup member body. The outer end face of the skirt 15 is substantially flat in a plane diametrical to the plunger axis, and the thickness of the skirt at its inner end is preferably greater than that at its outer end, thus making its inner surface 18 more acute to a diametrical plane of the member 12 than the surface 16. The normal spread or flare of the skirt is greater than the diameter of the barrel cavity but less than that of its enlargement 2, so that when the skirted portion of the plunger is in the enlargement, fluid may pass

freely therearound, as shown in Figs. 1 and 4, and when such skirted portion is drawn rearward into the reduced portion of the barrel a radial compression of the skirt is effected by reason of its free edge contacting with the barrel wall, as shown in Fig. 3.

In practice, it is found that the most desirable results are obtained by disposing the inner skirt taper **18** at approximately a 30° angle to a diametrical plane thereof and the outer taper **16** at approximately a 60° angle to such plane, or a 30° angle to a plane parallel to the plunger axis, when the member **13** is free of compression or distorting forces in any direction, as shown in Fig. 5. To facilitate future reference to these angles, the first angle is designated *a* and the second angle is designated *b*. When the member **13** is clamped between the members **11** and **12**, it is slightly compressed, thus effecting a slight inward drawing of the skirt portion, so that the angularity of its angle *a* is approximately 37° while that of the angle *b* is approximately 32°, as shown in Fig. 4. The increase of the angle *a* over that of the angle *b* increases the tendency of the skirt to resist a compressing force applied to its outer free edge.

When the plunger is drawn rearward into the reduced portion of the barrel bore the skirt portion of the resilient cup member **13** is pressed inward by contact of its free angular edge with the bore wall, as shown in Fig. 3, but is not material distorted in shape over its form when in the neutral position within the bore enlargement **2**, as shown in Fig. 4. This compressing action of the skirt **15** increases the angle *a* to approximately 52° and diminishes the angle *b* to approximately 28° and at the same time causes a slight tilting of the outer end surface of the skirt from a diametrical plane, as indicated in Fig. 3 by angle *c*. While during this rearward-stroke movement of the plunger the outer end edge of the skirt **15** has frictional coaction with the wall of the barrel, such coaction is not so great as to prevent the escape of displaced air around the plunger to the open end portion of the barrel.

Upon a forward or vacuum stroke of the plunger, the form of the cup member **13** and of its skirt **15** and the frictional coaction of the latter with the wall causes a rearward compression of the skirt and body portion of the cup member so that they assume a form and position relative to the barrel substantially as illustrated in Fig. 2, thus creating a very considerable and effective resistance to the admission of atmospheric pressure to the space at the rear of the plunger wherein a vacuum is created by the forward stroke of the plunger. During this vacuum stroke of the plunger, the angle *a* is lessened to approximately 28° and the angle of tilt of the lower edge portion of the skirt, which angle is designated *c*, is increased to approximately 18°. At the same time the inner end of the skirt is rearwardly tilted by the compressing action which takes place lengthwise of the skirt and into the body portion of the cup member toward its upper inner edge.

It will be understood that while the angles referred to are merely illustrative of one embodiment of the invention and of the action of the plunger cup, so far as it can be determined in operation, such angles may be varied within reasonable limits without departing from the spirit of the invention. It is found important, however, in obtaining the desired results to provide the resilient cup member of the plunger with a rather heavy body portion and with a relatively light skirt portion, which latter should not only extend downwardly from the body portion of the member, so that the upward end thrust thereon is opposed by the body member, but the outer surface of the skirt portion should be flared outward relative to the body portion. It is also desirable to dispose the inner wall of the skirt portion at a less incline to a diametrical plane than the outer wall of such portion, so that the outer end of the skirt portion is of less width than its inner end.

The plug **3** and packing unit **7** are disposed in a slightly enlarged portion **20** in the rear end portion of the barrel bore, and the packing unit is held to its seat against the inner shouldered end of the reduced portion of the bore by the threading of the plug **3** therein.

The packing unit **7** comprises two opposed spaced disk members **21** and **22**, which are centrally apertured to permit the free passage of the plunger stem therethrough and have their inner or adjacent faces of dished or concaved form. These disks are of hard rubber, or other suitable rigid material, preferably of a nature resistant to ink corrosion. Disposed between the disks **21** and **22** and clamped at their edges between the edge portions of such disks is a resilient soft rubber packing comprising one or more soft rubber disks **23**, in the present instance two in number, which are centrally apertured to permit the frictional passing of the plunger stem **6** therethrough. The disks **23** are preferably flat and while compressed at their outer edge portions by the clamping action of the disks **21** and **22**, their central portions, which are disposed within the enlarged space formed by the concaved portions of the clamping disks, are non-compressed other than by the frictional fitting of the plunger stem therein, and are free to move axially within said space as the stem **6** is reciprocated. This prevents the soft packing disks from having a firm binding coaction with the stem, thus rendering the stem guide free to be reciprocated within the packing, and at the same time providing a highly effective means for preventing the admission of atmospheric air to the rear end portion of the barrel cavity around the plunger stem when a vacuum is being created in the barrel by a forward stroke of the plunger.

A gasket **24** of disk-form and preferably of felt, which may be saturated with a lubricant if desired, is interposed between the plug **3** and clamping disk **22**, so that when the plug **3** is screwed home a clamping pressure is applied to the clamping disks through said gasket.

It is apparent that many changes in construction and arrangement of the parts of the features comprising the invention may be made without departing from the scope of the claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent, is:

1. In a fountain pen of the class described, a plunger having an operating rod projecting therefrom, said plunger comprising a cup member of soft resilient material having a body portion and a dependent skirt portion with its outer side flared with respect to said body portion and adapted alone to contact with a pen barrel in which operating, said plunger also including opposed clamping members for the body portion of the cup member of less diameter than the barrel opening.

2. In a fountain pen of the class described, a

plunger mounted in the pen barrel and having an operating stem projecting therefrom without one end of the barrel, said plunger comprising opposed clamping members of less diameter than the barrel bore, and a cup member of soft resilient material held between said clamping members, said cup member having a disk like body portion, and a flared depending skirt portion at one end with the thickness of the skirt portion greater at its inner end than at its outer end.

3. In a fountain pen of the class described, a plunger mounted in the pen barrel and having an operating stem projecting therefrom without one end of the barrel, said plunger comprising opposed clamping members of less diameter than the barrel bore, and a cup member of soft resilient material held between said clamping members, said cup member having a flared skirt portion at one end for outer side contact with the barrel wall, the outer side of said skirt portion being disposed at a greater angle to a diametrical plane thereof than its inner side.

4. In a fountain pen of the class described, a plunger mounted in the pen barrel and having an operating stem projecting therefrom without one end of the barrel, said plunger comprising opposed clamping members of less diameter than the barrel bore, and a cup member of soft resilient material held between said clamping members, said cup member having a disk like body portion which is substantially the same in diameter as the inner clamping members and is considerably larger in diameter than the opposite clamping member, and at such latter end is provided without the adjacent clamping member with a skirt portion which projects endwise from the body portion and has its outer side flared gradually outward on a taper from the side wall of the body portion and has its inner wall joining with the body portion at substantially the point of clamping of the smaller clamping member, said body portion being of less diameter than the pen barrel and the outer edge of the skirt portion being normally of greater diameter than the pen barrel.

5. In a fountain pen of the class described, a barrel having a bore with an enlargement at its open end portion, a plunger operating in said bore and having a stem projecting from the closed end of the barrel, said plunger comprising opposed clamping members both of less diameter than the barrel bore, and the outer one being of less diameter than the other, and a soft resilient cup member held between said clamping members with the outer clamping member engaging the cup member in inwardly spaced relation to its outer edge, said cup member having an axially thick disk like body portion which is of less diameter than the barrel bore and provided at its outer end with an axially projecting radially flaring skirt portion of greater diameter than said bore and of less diameter than its enlargement, said skirt portion being relatively thicker at its inner than at its outer end.

LLOYD A. KELLEY.