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C. K. LOVEJOY

3,242,907

FOUNTAIN PEN

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Fig. 1

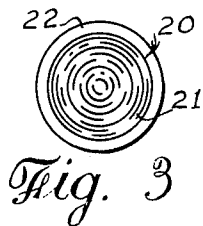
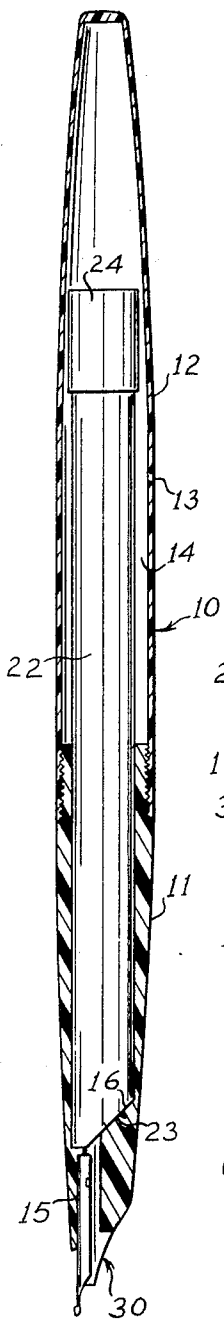


Fig. 2

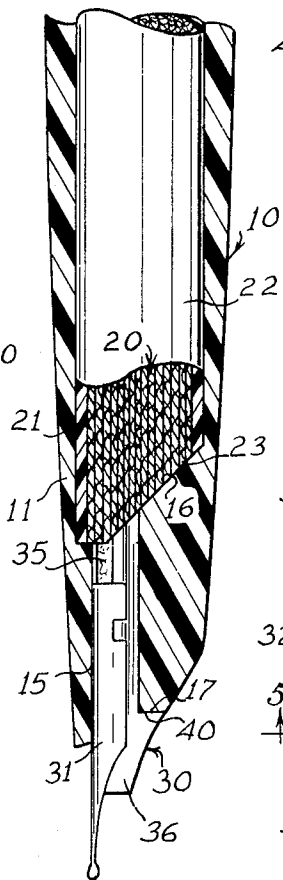


Fig. 4

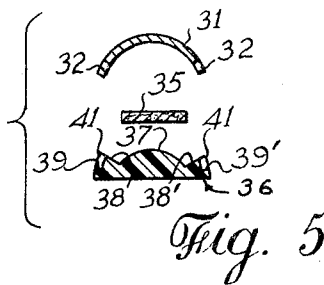
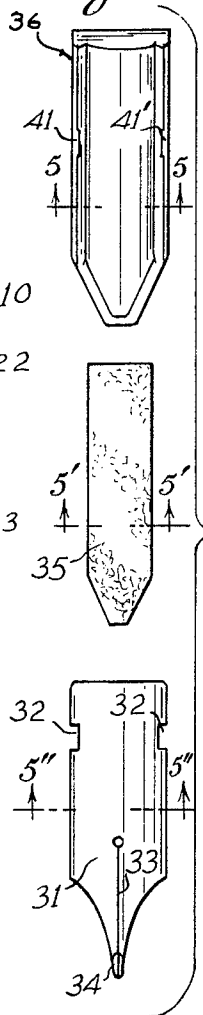
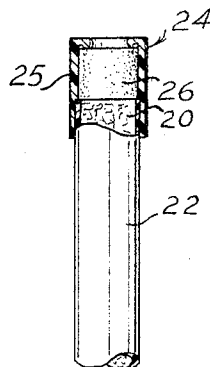


Fig. 6



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3,242,907

FOUNTAIN PEN

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4 Claims. (Cl. 120—50)

This invention relates to fountain pens and more particularly to one having a reservoir that includes a porous or cellular-like capillary mass which provides for the filling of the pen by capillary attraction and holds the ink supply in a stable state therein except when the pen is brought in contact with a writing surface.

Essentially the pen of the present invention includes three principal parts: (1) a two piece barrel, which is vented to the atmosphere; (2) a cellular reservoir structure of capillary size that is fabricated as a roll of mesh formed from a non-absorbent mono-filament material and disposed within a piece of tubing and (3) a point assembly that includes a writing nib, a nib support member and a fibrous tongue that is held between the nib and nib support member.

It is recognized that rolled mesh has been used in the past to form a cellular structure of capillary size that is capable of filling the reservoir with ink, keeping it in a stable state while the pen is not being used, and allowing flow of ink from the point when brought in contact with a writing surface. Such constructions are shown in early patents such as the one granted to M. C. Stone on March 21, 1882 as U.S. Patent 255,205 as well as the patent to William Smith that was accepted October 4, 1906 as British Patent 15,080. Both of these two early patents disclose a rolled mesh capillary structure in combination with a conventional nib point assembly. A latter patent that issued to J. T. Andersen on April 6, 1920 as U.S. Patent 1,336,119 disclosed the combination of a capillary porous mass as the reservoir element with an apertured writing point which is of the stylus type. Thus porous capillary elements for regulating the ink behavior have been combined in the past with stylus and nib point assemblies.

Point assemblies have included a fibrous member held between a nib support means and a nib, for example the early patent to E. M. Gordon that issued on September 11, 1884 as U.S. Patent 525,895 and the patent to R. D. Dickie that issued on December 9, 1902 as U.S. Patent 715,359.

Therefore, the principal novelty of the present invention resides in the shaping of the interior of the barrel as well as the forward portion of the capillary porous reservoir element so as to provide a configuration whereby the force of gravity is utilized to supplement the capillary forces developed in series within the pen when brought in contact with the writing surface to regulate the rate of flow of ink from the point to the writing surface.

It should be noted that the inner wall of the reservoir that is normally disposed on the underside of the pen during writing is slanted forward and downward toward the point so as to direct the flow of ink to and concentrate same at where the point assembly receives the ink from the reservoir. By this arrangement, when the pen is held in writing position, none of the reservoir is below the level where the point assembly receives ink, and therefore none of the capillary force of the point assembly is dissipated to overcome the force of gravity in feeding ink, as is found in prior art pens where the ink must be drawn up by capillary force from an ink pocket that is located below the area where the point assembly receives the ink from the reservoir. Therefore, in the pen of the present invention, it is possible to dispense more ink from the reservoir of a given size with better starting qualities.

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These and other features of the present invention are described in further detail below in connection with accompanying drawings in which:

FIG. 1 is a longitudinal cross section of the pen of the present invention;

FIG. 2 is an enlarged longitudinal cross section of the forward portion of the pen shown in FIG. 1;

FIG. 3 is a top plan view of the portion of the pen shown in FIG. 2;

FIG. 4 is an exploded top elevation of the point assembly;

FIG. 5 is an exploded cross section of the components of the point assembly taken along the respective lines 5—5, 5'—5', and 5''—5'' shown in FIG. 4;

FIG. 6 is a partial longitudinal cross section of the rear of the reservoir element and ink capsule shown in FIG. 1.

Now, referring to the drawings, the present invention includes a two piece plastic barrel 10 that has a forward barrel portion 11 that is threadably secured to a rear barrel portion 12 that has an aperture 13 in its side wall for venting the interior of the barrel 10 to the atmosphere.

The interior of the pen barrel 10 is provided with a central main bore 14 and the forward barrel portion 11 is provided with a forwardly extending semicircular aperture 15 of reduced cross-sectional area. It will be noted that at the juncture between the main bore 14 and the forwardly extending aperture 15 there is provided an inwardly and forwardly slanted surface 16 which when the pen is held in normal writing position is on the underside of the barrel, the angle of said surface then being such that it is substantially 90° or less with respect to the vertical. By this arrangement, the force of gravity can be utilized to supplement the capillary force of the pen system when in contact with a writing surface to regulate the flow of ink from the point. In other words, the slant of the interior of the barrel is such that during writing it is either inclined downwardly or is in a horizontal plane. A forwardly facing stop shoulder 17 is formed on the forward barrel portion 11 adjacent the outer extremity of the semicircular aperture 15.

Within the central bore 14 there is removably disposed a porous capillary structure 20 formed of rolled mesh 21 made from a non-absorbent monofilament, a preferred type being a 15 denier nylon fabric in a tricot weave. The rolled mesh 21 is enclosed within a transparent sleeve member 22 made of a fluorocarbon resin such as the product sold under the trademark "Teflon FEP," which is a copolymer of tetrafluoroethylene and hexafluoropropylene, marketed by E. I. du Pont de Nemours & Co., Wilmington, Delaware.

In the present embodiment a piece of nylon mesh 21 having a length of approximately six inches and a width of approximately three inches is rolled lengthwise so as to fit in a sleeve member 22 having an internal diameter ranging between .213 and .218 inch.

It should be noted that the forward portion of the sleeve member 22 as well as the rolled mesh 21 is shaped to form a slanted surface that conforms to the interior of the barrel so that the exposed surface of the mesh 21 is in abutting contact with the slanted interior surface 16 of the barrel 10 at their respective forward ends.

In the event it is desired to fill the pen with water instead of ink, a capsule 24 containing an ink concentrate may be fitted on the rear of sleeve 22. The ink capsule 24 consists of an open ended sleeve 25 that has a suitable ink concentrate impregnated within a porous member 26 such as a sponge or porous polyethylene.

A suitable ink concentrate can be prepared by dissolving a water soluble dye of 10 to 15% concentration with

$\frac{1}{2}$ to 1% salicylic acid in methanol. The porous member 26 is then dipped in the resulting solution and the methanol is driven off by heating, leaving the sponge 26 impregnated with ink concentrate. It is recognized that if the ink capsule 24 is not used, the capillary structure 20 can be filled with ink by immersing the rear of sleeve 22 in an ink supply.

A point assembly 30 is removably fitted into the semi-circular aperture 15 and includes a nib 31 and a nib support member 36 which has its upper side 37 formed in an arcuate configuration that conforms to the radius of the curvature of the cross section of the nib 31. The nib 31 has formed at the rear of its outer sides positioning slots 32 and in its forward portion a capillary slit 33 of approximately .002 inch that terminates at the forward end in a writing ball 34. Between the nib 31 and nib support member 36 is disposed a fibrous tongue 35 which may be a piece of filter paper. It should be noted that the nib support member 36 is provided with upwardly extending lugs 41 and 41' that are received within slots 32 formed in the outer sides of the nib 31 for fixing the relative position of the nib 31 with respect to the nib supporting member 36. The point assembly 30 is held by a friction fit within the forwardly extending semi-circular aperture 15 so that it is in abutting communicative contact with the porous mass 20 that comprises the reservoir section.

The proper longitudinal positioning of the point assembly with respect to porous capillary mass 20 is attained when the forwardly facing stop shoulder 17 of forward barrel portion 11 abuts rearwardly facing stop shoulder 40 formed on nib support member 36.

By referring to FIG. 4 and FIG. 5 it will seem that the nib support member 36 receives in overlying relation the fibrous tongue 35 which is supported at its sides by the upwardly extending tongue support flanges 38 and 38'. The nib 31 overlies the tongue 35 and is properly positioned when ears 41 and 41' are fitted into nib slots 32 with the outer edges of nib 31 abutting the nib support flanges 39 and 39'.

In a fountain pen of the present type having a capillary porous mass disposed within the reservoir it is well to consider the properties of capillary attraction, cohesion, adhesion and surface tension as related to fluids in contact with solid matter.

The exception to the otherwise general statement that the upper surface of a free body of liquid at rest is level, consists in the condition at the edges of the surface area, close to a bounding solid. If the liquid wets the solid (e.g., water and clean glass), it is because there is a greater attraction between the liquid and the solid than between particles of the liquid, or adhesion is stronger than cohesion. On the other hand, if the liquid does not wet the solid (e.g., mercury and glass) cohesion is stronger than adhesion. The curved upper surface is called a meniscus.

With many liquids such as water, ethyl alcohol, chloroform, benzene, turpentine, and olive oil the angle of contact between liquid and glass is 0° and in capillary tubes the meniscus is approximately hemispherical. In such a case the capillary rise $= 2\gamma / (d_1 - d_g)r$, where γ is the surface tension, d_1 and d_g are the weight densities of the liquid and the gas (or vapor), and r is the internal radius of the capillary tube.

In capillary fountain pens that are vented to the atmosphere where the porous mass is of a single given material the surface tension is constant; and where a given ink is used the weight density of said ink and air are constant. Therefore the measure of capillary attraction that is set forth in the foregoing formulation can be reduced to simply the inverse ratio of the radius involved which is

the dimension for determining the size of the capillary tube or in the case of a porous mass the cells or interstices. Hence with a given material for forming the mesh 21, to operate with a given selected ink, the smaller the mesh size, and the tighter the winding, the greater the capillarity.

Since it is the purpose of any pen to deliver ink to the writing surface, the capillarity of the writing surface must be greater than that of point assembly and the capillarity of the point assembly must be greater than the capillarity of the porous reservoir unit 20 to effect transfer of ink from the pen to the writing surface.

The present invention has been described in detail above for purposes of illustration and is not intended to be limited by this description or otherwise except as defined in the appended claims.

I claim:

1. A fountain pen comprising a barrel provided with a central internal bore therein, a point assembly disposed in the forward end of said barrel that includes a nib support member having a rearwardly facing stop shoulder and a nib carried on said support member, and a capillary reservoir element disposed within said central bore for containing a supply of ink, said central internal bore of said barrel having its forward end terminating in an inwardly and forwardly slanted surface within the barrel on the side that is the underside of the pen when held in normal writing position so that during writing said slanted surface makes an angle of 90° or less with the vertical, whereby the force of gravity is utilized to supplement the capillary force of the pen system for regulating the flow of ink from said nib when said nib is in contact with a writing surface, said capillary reservoir element being formed at its forward end to correspond to the inwardly and forwardly slanted internal barrel surface so that abutting contact is established therebetween for effecting transfer of ink from said capillary reservoir element to said point assembly, said barrel further having a forwardly facing stop shoulder for cooperating contact with said rearwardly facing stop shoulder of said nib support member for properly positioning said point assembly in communicating relation with said capillary reservoir element.

2. A fountain pen as claimed in claim 1 and further characterized in that a fibrous tongue is held between the nib and nib support member.

3. A fountain pen as claimed in claim 2 and further characterized in that said capillary reservoir element is formed by a roll of non-absorbent, mono-filament mesh material disposed within a tubular member.

4. A fountain pen as claimed in claim 3 and further characterized in that said capillary reservoir element is adapted to receive at its rearward end a capsule containing an ink concentrate so that the pen may be filled with water to provide an ink supply.

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