April 22, 1952 F. V. SILVER 2,594,083

BALL-POINT PEN AND CAP

Filed July 8, 1948

Fig. 1

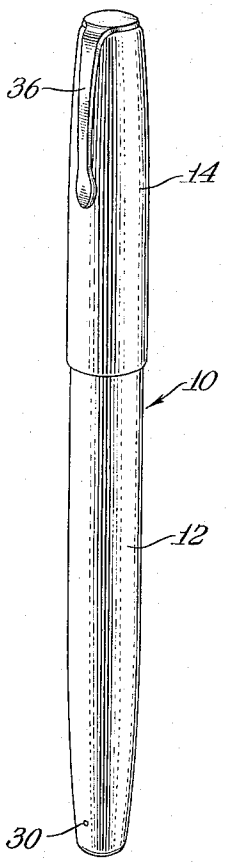


Fig. 2

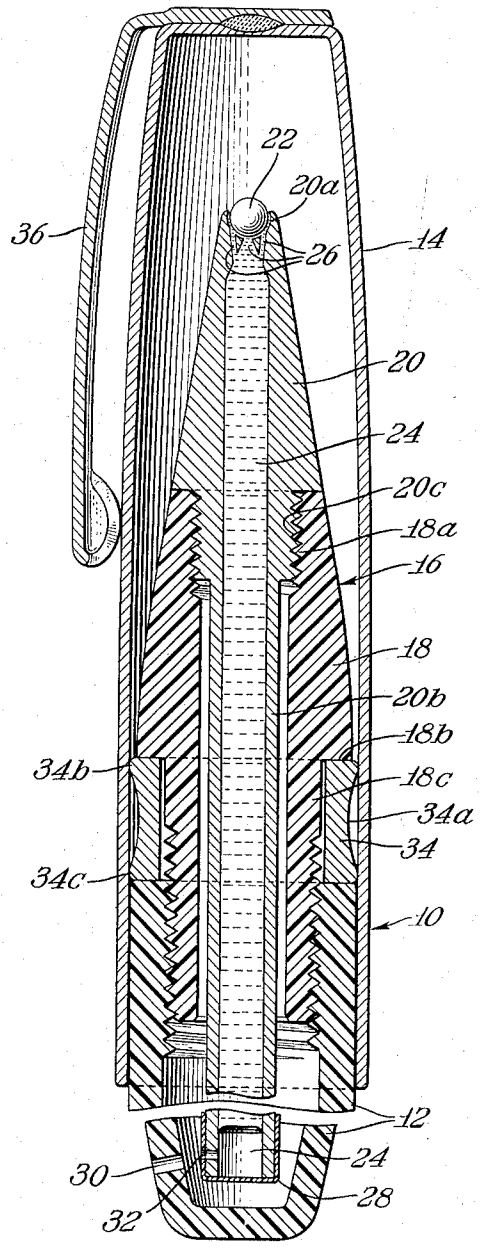
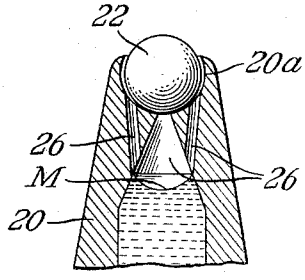


Fig. 3



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BALL-POINT PEN AND CAP

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3 Claims. (Cl. 120—42.4)

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This invention relates to an improved fountain pen and relates particularly to an improved construction for ball point type writing pens.

The ball point pen constructions heretofore known have been subject to certain inherent disadvantages. The most commonly experienced disadvantage is the failure, or partial failure, of the flow of ink. The flow failure generally occurs after the pen has not been used for some time and is generally caused by an air lock in the ink channel immediately adjacent the ball tip.

During periods of non-use, the writing tip of the pen is generally inserted within the pen cap and carried in inverted position by means of a clasp affixed to the pen cap.

The inks used in ball-bearing type pens are viscous fluids and are not susceptible to easy or ready flow. However, during non-use of the pen, when the pen itself is inverted, the ink tends to withdraw somewhat within its channel and to retreat from the immediate vicinity of the ball bearing. The distance the ink withdraws from the ball bearing depends upon the viscosity of the particular ink used, temperature and atmospheric conditions, etc. When the ink has been withdrawn by reverse flow, its meniscus will form at a point below the ball bearing in the ink channel and air will enter the channel between the ball bearing and the meniscus and thus forms an air lock.

When the pen is again held in writing position in order for the ink to flow evenly about the ball bearing, this air lock must be broken and the surface tension at the meniscus of the ink column must be overcome.

In the ball-bearing type pens heretofore known, no efficient means for overcoming these obstructions to free flow of the ink has been provided.

In accordance with the features of this invention, the aforementioned disadvantage is overcome by providing a ring seal member which embraces the ink cartridge and by providing a press-fitted cap to fit over the ring and ball bearing when the pen is not in use. When the cap is being removed, its interior is sealed by the ring from the influx of air so that a partial vacuum is created within the cap about the ball bearing until the cap is completely removed from the ring seal. The low pressure area or partial vacuum created within the cap during its removal induces the flow of air from behind the ball and breaks the previously described air lock. It is a well known law of physics that fluids will tend to move from a higher to a lower pressure area and it is this law that is utilized in overcoming the resistance to the outward flow of ink brought about by the air lock and by surface tension.

It is, therefore, an object of this invention to

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provide an improved fountain pen construction.

Another object of this invention is to provide a ball point pen construction that provides an even, continuous flow of ink from the start when in use.

Other and further objects of the present invention will be apparent to those skilled in the art from the following detailed description of the annexed sheet of drawing, which by way of preferred example only, illustrates one specific embodiment of the invention.

On the drawing:

Figure 1 is a perspective view of an assembled pen cartridge and cap constructed in accordance with the features of the present invention;

Figure 2 is a broken vertical cross-sectional view to an enlarged scale, of the cartridge and cap of Figure 1; and

Figure 3 is an enlarged fragmentary cross-sectional view of the writing tip of the pen showing the ink channel to the writing ball bearing.

As shown on the drawing:

The reference numeral 10 indicates generally an assembled ball point pen constructed in accordance with the features of this invention. As seen in Figure 1, the pen 10 comprises a cartridge casing 12 and a non-vented cap 14 for covering and protecting the writing point of the pen during non-use. The casing 12 and the cap 14 are of generally cylindrical configuration, the cap 14 being tubular and so dimensioned as to telescopingly and snugly fit the casing 12 toward the writing end of the pen.

The casing 12 is also hollow and tapped adjacent its open end to receive the pen cartridge, indicated enerally by the reference numeral 16. The cartridge 16 comprises a cartridge barrel 18 having a reduced externally threaded end for threading within the casing 12 and a writing tip and channel member 20. The tip member 20 is tapered inwardly toward the writing end which provides a socket 20*a* for receiving a writing ball bearing 22. A centrally disposed longitudinal ink channel 24 runs the entire length of the writing tip and channel member 20, communicating with the socket 20*a* through the feeder channels 26.

The tip and channel member 20 has a reduced diameter stem 20*b* which fits into the hollow barrel 18 and is secured therein by the engagement of external threads 20*c* on the stem and internal threads 18*a* on the barrel 18 at the end adjacent the writing end of the pen. The stem 20*b* is open ended providing the channel 24 but the end portion is covered by a sleeve 28 provided to prevent excessive leakage should the column of ink lose viscosity and tend to flow. An air hole 30 is provided through the casing 12 adjacent the open end of the stem 24, and the sleeve 28

and stem 20b have a communicating aperture 32 so that air at atmospheric pressure is within the channel 24 at the end of the ink column opposite the writing tip.

A sealing ring 34 embraces the reduced and threaded end portion 18c of the barrel 18 and rests against the shoulder 18b on the barrel provided by the reduced end 18c. When the casing 12 is threaded over the reduced end 18c, it secures the sealing ring 34 in position against the shoulder 18b. The sealing ring 34 has a concave outer periphery 34a and presents two peripheral sealing surfaces 34b and 34c to the inner surface of the cap 14 when the same is pressed over the writing end of the pen as illustrated in Figure 2.

Contact of the cap 14 with the seal ring 34 and the casing 12 affords an air-tight fit of the cap over the writing end of the pen. The cap 14 has a pocket clasp 36 brazed or otherwise secured thereto in a manner so as not to permit the entry of air within the cap when the same is secured over the writing tip of the pen.

During periods of non-use, the pen is assembled with the cap as illustrated in Figures 1 and 2 and generally held in said position with the ball bearing writing tip upward. Due to the forces of gravity, the viscous ink column will drop in the channel 24 and the meniscus M of the ink column may form well below the socket 20a and below the feed channels 26 as illustrated in Figure 3. The meniscus M is formed in the manner illustrated due to the wall of the channel 24 being wetted by the ink fluid and the forces of attraction of the particles making up the ink fluid. This attraction force must be overcome in order for the ink to flow toward the ball bearing 22.

Also the gravitational pull of the ink fluid mass aids in the meniscus development and this force as well must be overcome in order to permit the ink to flow toward the ball bearing 22.

Air at the pressure within the cap 14 as sealed by the ring 34 is within the socket 20a and feed channels 26. The force exerted by this air pressure must also be overcome before the ink will again flow from the column 24 about the ball bearing 22 for writing purposes.

When the cap 14 is removed from the writing point, it is slipped from the casing 12 and ring 34, but during its removal and until its open end has slipped past the ring 34, the cap is sealed from the entrance of atmospheric air. Due to the increase of volume so produced within the cap a partial vacuum is created about the ball bearing and within the feed channels 26, which serves to break any air lock and to overcome the surface tension tending to resist flow of the column of ink 24, and to thereby induce a flow of the ink toward the ball bearing 22.

It is obvious, therefore, that the aforedescribed pen structure incorporating the seal ring and press-fitting cap provides a ball bearing type pen having improved ink flowing characteristics.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a fountain pen, a cylindrical barrel, an ink feed channel therein vented to atmospheric pressure, a ball seated in the end of the channel to be wetted by ink flowing therethrough under force of gravity and movable from sealing relationship with its seat, a ring seal projecting from the outer surface of the barrel intermediate the ends thereof, a closed end cap engageable over the ball end of the barrel and engageable with the seal with the open end extending past the same for an appreciable distance lengthwise of the barrel whereby withdrawal of the cap will attenuate the air in the same to create a partial vacuum therein to unseat the ball and break an air lock formed by recession of ink from the ball due to the force of gravity when the pen is carried in upright or vertical position with the ball uppermost.

2. In a fountain pen, a cylindrical barrel, an ink feed channel therein vented to atmospheric pressure, a writing ball seated in the end of the channel to be wetted by ink flowing therethrough under force of gravity and movable from sealing relationship with its seat, a double ring seal projecting from the outer surface of the barrel intermediate the ends thereof, a closed end cylindrical cap engageable over the ball end of the barrel with its interior contacting the seal in sealing relationship and extending for an appreciable distance lengthwise of the barrel past the seal whereby withdrawal of the cap will attenuate the air within the cap and create a partial vacuum therein to unseat the ball and break an air lock formed by recession of ink from the ball due to the force of gravity when the pen is carried in upright or vertical position with the ball uppermost.

3. In a fountain pen, a casing member, an ink feed channel therein vented to atmospheric pressure, a ball seated in the end of the channel to be wetted by ink flowing therethrough under force of gravity and movable from sealing relationship with its seat, a cylindrical seal projecting from the outer surface of the casing intermediate the ends thereof, a closed end cap having a cylindrical cavity therein engageable over the ball end of the casing in sealing relationship with the seal and extending there past for an appreciable distance lengthwise of the casing whereby withdrawal of the cap will attenuate the air within the cap and create a partial vacuum therein to unseat the ball and break an air lock formed by recession of ink from the ball due to the force of gravity when the pen is carried in upright or vertical position with the ball uppermost.

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