

[54] **PEN WITH INK INJECTION SYSTEM**

[76] Inventor: **Edward Bok**, Burgemeester
Amersfoordtlaan 82,
Badhoevedorp, Netherlands

[22] Filed: **Sept. 11, 1973**

[21] Appl. No.: **396,149**

978,419	12/1910	Wirt.....	401/245
2,107,150	2/1938	Heising.....	401/229 X
2,255,093	9/1941	Ziegler.....	401/228 X
2,274,470	2/1942	Boyle et al.....	401/246
2,291,859	8/1942	Andrews.....	401/259 X
2,627,844	2/1953	Johnson.....	401/259
3,319,837	5/1967	Mueller.....	222/212

FOREIGN PATENTS OR APPLICATIONS

1,306,685	9/1962	France.....	401/230
-----------	--------	-------------	---------

[30] **Foreign Application Priority Data**

Sept. 8, 1972	Netherlands.....	7212745
Oct. 16, 1972	Netherlands.....	7213945
Nov. 14, 1972	Netherlands.....	7215137
Dec. 12, 1972	Netherlands.....	7216870
Jan. 8, 1973	Netherlands.....	7300219
Jan. 8, 1973	Netherlands.....	7300220
Feb. 19, 1973	Netherlands.....	7302247

Primary Examiner—Lawrence Charles
Attorney, Agent, or Firm—Staas & Halsey

- [52] **U.S. Cl.** **401/230**; 401/199; 401/209;
401/259; 401/261; 401/183
[51] **Int. Cl.² ... B43K 5/10**; B43K 1/08; B43K 1/10;
B43K 1/12
[58] **Field of Search**..... 401/199, 230, 258-260,
401/183-185, 245, 246, 217, 261; 222/206,
207, 212

[56] **References Cited**

UNITED STATES PATENTS

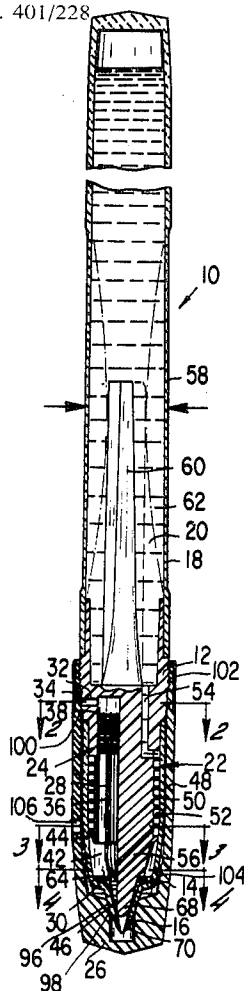
723,113	3/1903	Wirt.....	401/228
---------	--------	-----------	---------

[57]

ABSTRACT

The present invention relates to a pen having a first compressible ink reservoir, a second ink reservoir, a writing tip in communication with the second reservoir, a venting system extending from the second reservoir to the atmosphere and a channel operatively connecting the first and second reservoirs for the purpose of periodically transferring ink from the first reservoir to the second reservoir.

13 Claims, 13 Drawing Figures



SHEET 2 OF 2

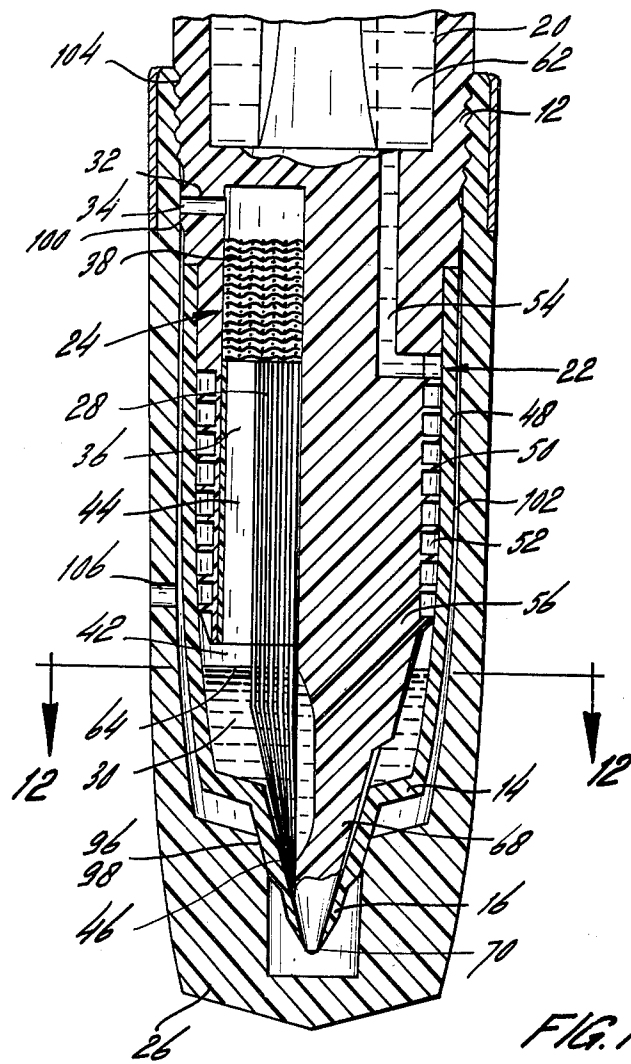


FIG. 11

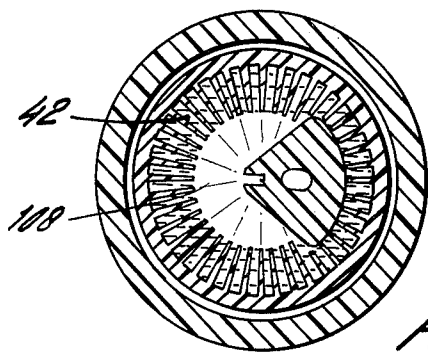


FIG. 12

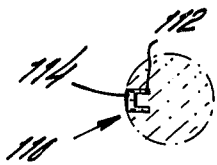


FIG. 13

PEN WITH INK INJECTION SYSTEM

BACKGROUND OF THE INVENTION

Drafting and scribing pens are frequently provided with an ink reservoir, a writing point in communication with the reservoir and a channel permitting the ink reservoir to be vented to the atmosphere. Such conventional drafting and scribing pens are frequently provided with systems for automatically supplying ink to the pen point and venting the ink reservoir. Pens featuring the automatic supplying of ink and venting of the reservoir are subject to deficiencies in operation stemming primarily from changes in the temperature and the pressure of the air in the ink reservoir. These changes in temperature frequently result in significant differences in the downward thrust on the ink in the passage of the tip of the pen and correspondingly significant changes in the output of ink. As will be apparent from the foregoing, even minor differences in the downward thrust on the ink may result in ink leaking from the pen in the form of droplets, both from the writing point as well as the venting channel.

SUMMARY OF THE INVENTION

In the present invention, the pen holder is provided with a first ink reservoir while the pen nib chamber is formed as a second ink reservoir. A pen tip is in communication with the pen nib chamber. A non-hydraulic injection channel operatively connects the lower portion of the first ink reservoir with the lower portion of the second ink reservoir while a venting system extends upwardly from the lower end of the second reservoir and is provided with a buffer for collecting ink urged therein from the second reservoir. The first ink reservoir is compressible to transmit via the injection channel a limited amount of ink into the second reservoir, the capacity of the ink buffer of the injection channel preventing during increases in temperature and pressure inside the first reservoir the expulsion of ink therefrom via the injection channel into the second reservoir. Moreover, the pen holder functions as an injection block extending downwardly into the lower end of the pen tip so as to act as the main bearer of the pen. The flexible sidewall of the lower end of the pen tip during use of the pen provides for the limited sideward displacement of the bearer.

BRIEF DESCRIPTIONS OF THE DRAWINGS

FIG. 1 is a vertical sectional view of the pen of the present invention;

FIG. 2 is a cross-sectional view of the pen taken along line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view of the pen taken along line 3—3 of FIG. 1;

FIG. 4 is a cross-sectional view of the pen taken along line 4—4 of FIG. 1;

FIG. 5 is an enlarged vertical sectional view of the lower end of the pen;

FIG. 6 is a bottom view of the lower end of the pen illustrated in FIG. 5;

FIG. 7 is an enlarged vertical sectional view of a different embodiment of the lower end of the pen;

FIG. 8 is an enlarged vertical sectional view of still another embodiment of the lower end of the pen;

FIG. 9 is an enlarged vertical sectional view of an additional embodiment of a pen nib applicable for use with the present invention featuring a fibrous tip; and

FIG. 10 is an enlarged vertical sectional view of an additional embodiment of a pen nib applicable for use with the present invention featuring a stylographic tip.

FIG. 11 is an enlarged vertical sectional view of the lower end of the pen;

FIG. 12 is a cross sectional view of the pen taken along line 12—12 of FIG. 11; and

FIG. 13 is a cross sectional view of the ink feed of an existing fountain pen.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As illustrated in FIG. 1, the pen of the present invention is designated generally by the reference numeral 10 and consists of a holder 12 which is provided with a nib 14 and a top 16 to which is attached a barrel 18 which serves as an enclosure defining a first reservoir 20. The reference numeral 22 designates generally the injection system while the reference numeral 24 designates generally the venting system. Finally, the cap 26 is releasably secured to the barrel 18.

As further illustrated in FIG. 1, the venting system 24 includes a channel 28 extending upwardly from the pen nib chamber or the second reservoir 30 and terminating upwardly in a cross venting channel 32. As will be apparent from FIG. 2, the cross channel 32 operatively connects the channel 28 with the opening 34 which is exposed to the atmosphere. Within the venting channel 28 are located a plurality of upwardly extending ink transporting grooves 36, as illustrated in FIG. 3, which terminate in an ink lock 38 which preferably consists of a plurality of wire screens 40, as illustrated in FIG. 2.

Within the pen nib chamber 30 are located a plurality of upwardly extending ink grooves 42, as illustrated in FIG. 4, which operatively connect the ink grooves 36 and the buffer compartment 44 with the ink passage 46 of the pen tip 16.

As further illustrated in FIG. 1, the sidewall of the holder 12 is provided with a spiralled groove while the pen nib sidewall 48 presses against the separation walls 50 thus defining the injection channel 52 which at its upper end is connected via channel 54 to the lower end of the first ink reservoir 20 and with its lower end via the channel 56 to the lower end of the pen nib chamber or second chamber 30.

The sidewall 58 of the barrel 18 is flexible and thus may be manually deformed, it being noted that the upper extension 60 of the holder 20 acts to limit the inward displacement of the wall 58.

The first reservoir 20 contains ink 62. Thus, as the sidewall 58 is depressed as the pen is in its use position ink is urged via the injection system 22 into the pen nib chamber or second reservoir 30. The significant buffer capacity of the injection system 22 limits the quantity of injected ink to filling only the lower end of the chamber or reservoir 30.

After the sidewall 58 has been compressed, the resilient characteristics of the wall 58 returns same to its normal position illustrated in solid lines in FIG. 1, at which time ink is automatically removed under the force of suction from the second reservoir 30 until the level of ink reaches the lower end of the channel 56. Thereafter, air is capable of being vented through the injection system 22 into the first ink reservoir 20 to replace the injected ink.

The column 64 of ink within the second reservoir 30 has a small dimension resulting in a relatively small downward thrust on the ink within the passage 46. During the suctioning of ink and air to the first reservoir 20, ink is returned first and thereafter air is admitted, the air thereby expelling the greater part of the ink in at least the lower and middle sections of the injection system 22. Thus, the system is able to act as a buffer in the receiving and buffering of ink during rises in temperature or pressure in the reservoir 20.

The ink buffering feature is of great significance since even under extreme temperature differences the flow of ink is prevented from the first reservoir 20 to the second reservoir 30. Due to this feature, the quantity of ink in the second reservoir 30 remains limited, whereby in the opposite position of the pen the ink collects in the transport grooves 42 and the buffer compartment 44. Thus, a small amount of ink may enter the transport grooves 36 in the venting channel 28 and eventually reach the ink lock 38 where it remains collected until in the pen-use position at which time the ink is carried off downwardly via the grooves 36.

The holder 12 may be provided with a lower portion 68 which extends downwardly beyond the bottom 70 of the pen tip 16, as illustrated in FIG. 5. In this embodiment, the extension 68 functions as a bearer while the flexible sidewall of the pen tip 16 functions merely as an enclosure for the ink passage 46.

Due to the flexibility of the sidewall of the flexible tip 16 acting in combination with the slits 74, 76, 78 and 80, as illustrated in FIG. 6, the bearer 68 is sidewardly displaceable within the ink passage 46 thus defining a wider opening of the ink passage if and when the downward thrust on the pen 10 is increased. Thus, in this embodiment the ink flow through a clogged up ink passage may be restored by means of repeated sideward movement of the bearer 68 in different directions.

In the further embodiment illustrated in FIG. 7, the slits 74, 76, 78 and 80 are omitted while greater flexibility of the sidewall of the pen tip 16 is achieved as a result of increasing the spacing between the pen tip 16 and the lower extension of the bearer 68 thus enabling sideward movement of the bearer 68.

In the embodiment illustrated in FIG. 8, the bearer 68' comprises a metal insert 82 terminating at the lower end thereof in a seat 84 within which is mounted for rotation a ball 86. In this embodiment of the invention, the ball 86 runs smoothly and lightly over the paper, it being understood that it is not necessary for the ball 86 to function as an ink transport mechanism as in the case of existing ball tipped pens.

In the embodiment illustrated in FIG. 9, a nylon pen tip 16'' provided with capillary passages is positioned within the pen nib 14'' while the capillary action of the tampon 88 transports ink from the channels 42'' and functions as an ink collector.

In the additional embodiment illustrated in FIG. 10 there is disclosed a stylographic pen 10''' provided with a cleaning wire 90 which is longitudinally displaceable within the ink passage 46'''. As further illustrated, the ring 92 encloses both the wire 90 and the weight 94 within the pen nib chamber 30'''. As will be further apparent, the pen nib 14''' is secured to the holder 12''' by the screw thread 95.

It will be readily apparent that other pen tip configurations are contemplated within the scope of the present invention and may include by way of exemplifi-

cation but not limitation a slitted metal pen tip such as used in conventional fountain pens.

When the pen is not being used, the ink passage 46, as illustrated in FIG. 1, is sealed off by means of the flange 96 of the protective cap 26 which is urged against the corresponding flange 98 of the pen tip 16. Moreover, the venting opening 34 is sealed off by means of the sidewall sealing segment 100 of the cap 26.

Finally, as the cap 26 is secured to the holder 12 by means of the screw thread 104, the air within the interior of the cap 102 cannot be compressed since air is permitted to escape via the opening 106 in the sidewall of the cap 26.

This feature is important when contrasted to existing fountain pen constructions. Both the major capillary ink feed channels 112, and the capillary collector channel 114 of the ink feed bar positioned in the ink feed 110, are filled with ink since an ink lock is created preventing the spontaneous leakage of ink through the ink feed, and the system functions as an ink collector with frequent receiving of expelled ink from the reservoir. During writing, a highly variable ink output via the pen tip is achieved, particularly with pens having a large size writing point.

I claim:

1. A pen, comprising:

a first ink reservoir,
a second ink reservoir beneath said first ink reservoir,
a pen tip in capillary communication with said second ink reservoir,
venting means extending upwardly from a position near the bottom of said second reservoir to the atmosphere,
at least one injection channel extending downwardly from said first reservoir to a position near the bottom of said second reservoir and of sufficient length to avoid capillary ink transport from said first reservoir to said second reservoir; and
means to manually inject ink from said first reservoir to said second reservoir.

2. A pen as in claim 1, wherein said venting means comprises an ink buffer having a volume larger than that of the maximum increase in volume in said first reservoir under a temperature increase of 5° C.

3. A pen as in claim 1, wherein said venting means comprises an upwardly extending main venting channel of large lateral dimension avoiding capillary ink filling thereof.

4. A pen as in claim 3, wherein said venting means further comprises a plurality of capillary ink buffer channels in communication with said ink passage of said pen tip.

5. A pen as in claim 4 wherein said means to manually inject ink from said first reservoir to said second reservoir comprises a compressible wall defining said first reservoir and operable to move between a first normally expanded position and a second compressed position, means automatically returning said wall to said first position after being compressed, and means limiting said second compressed position to a position such that the total ink buffer capacity of said ink buffer channels in said second reservoir is larger than the maximum achievable volume of ink injected into said second reservoir during a single injection.

6. A pen as in claim 5, including a holder, said venting means contained in said holder, said venting means

5

further comprising a cross venting channel connecting a venting opening in the sidewall of said holder with said main venting channel, said ink buffer channels of said second reservoir being arranged so as not to terminate in said cross venting channel.

7. A pen as in claim 6, whereby at least part of said buffer channels include upwardly extending open sides in communication with said venting channel, and wherein said cross venting channel terminates into a section of said main venting channel that is not occupied by said ink buffer channels.

8. A pen as in claim 6, wherein at least part of said ink buffer channels are part of a capillary tampon structure.

9. A pen as in claim 6, whereby the lower end of said injection channel is contained within said holder, a central bearer is positioned within the ink passage of said pen tip, said bearer constituting the downward extension of said holder and extending downwardly beyond the lower end of said pen tip.

6

10. A pen as in claim 9, whereby the lower end of said pen tip comprises a flexible part of a flexible pen nib, and the lower end of said bearer is sidewardly displaceable with respect to said pen tip.

11. A pen as in claim 10, including at least one slit positioned within the lower end of said pen tip.

12. A pen as in claim 10, including a ball located in the bottom of said bearer, the lower end of said ball extending downwardly beyond the lower end of said pen tip.

13. A pen as in claim 6, including a protective cap provided with means for sealing off said venting opening and said ink passage in said pen tip, the sidewall of said protective cap being provided with an opening located between said sealing off means so as to connect the interior of said cap with the atmosphere, the interior of said cap between said sealing off means having a greater diameter than the corresponding outside of said pen.

* * * * *

20

25

30

35

40

45

50

55

60

65