May 6, 1969 H. HEBBORN ET AL 3,442,597

FOUNTAIN PEN

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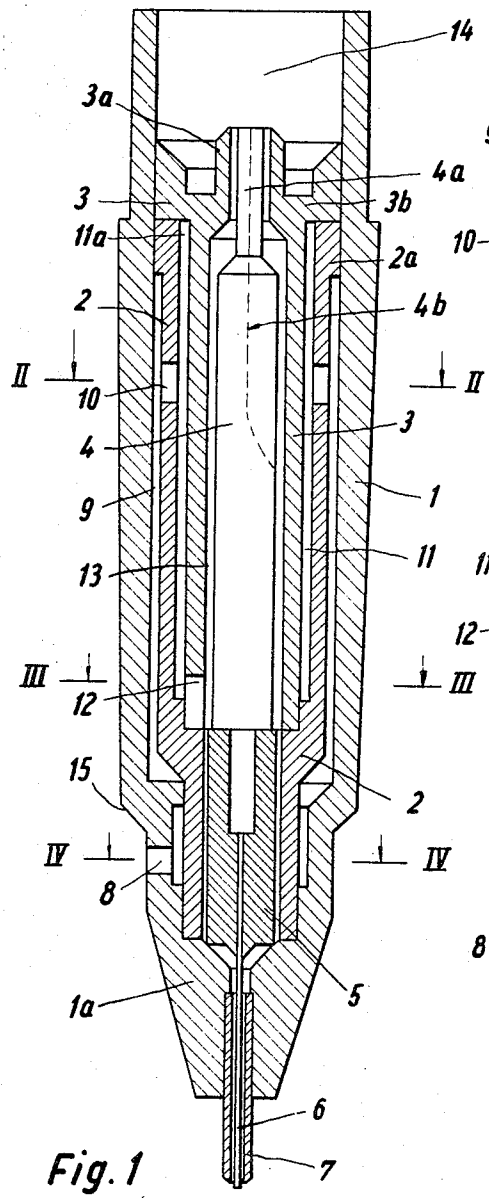

Fig. 1

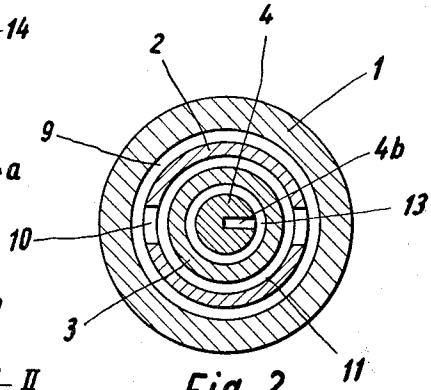

Fig. 2

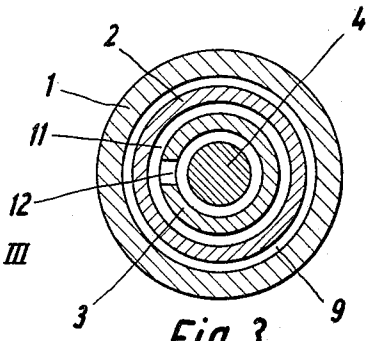

Fig. 3

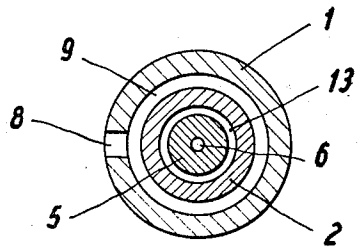

Fig. 4

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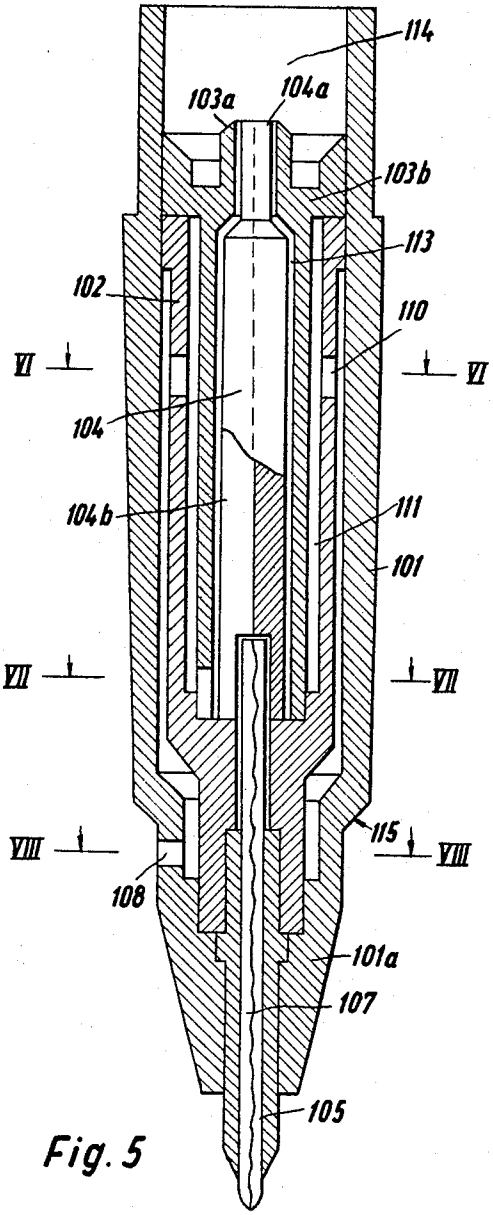

Fig. 5

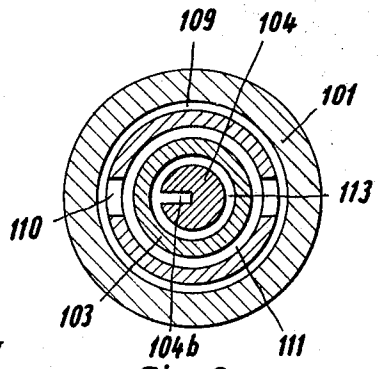

Fig. 6

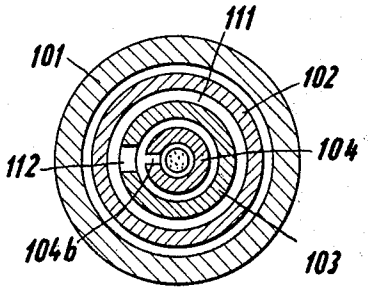

Fig. 7

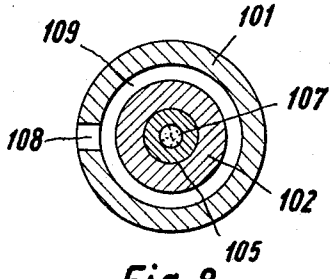

Fig. 8

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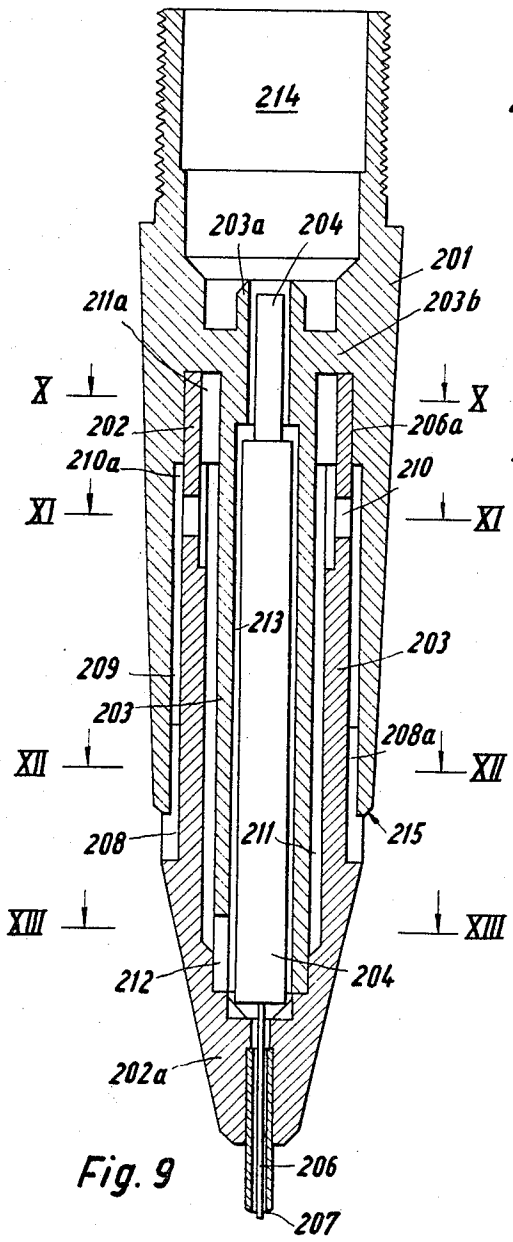

Fig. 9

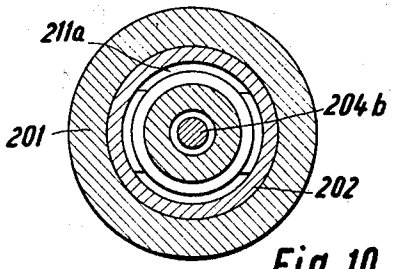

Fig. 10

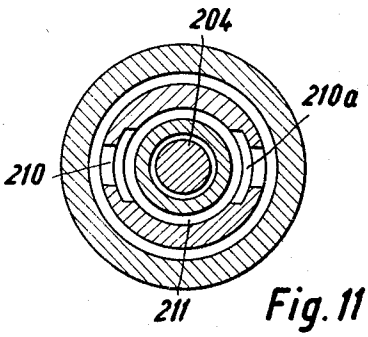

Fig. 11

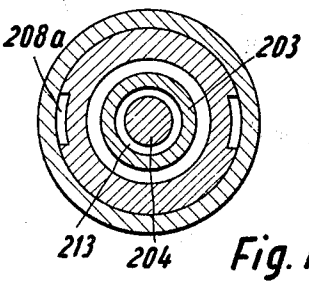

Fig. 12

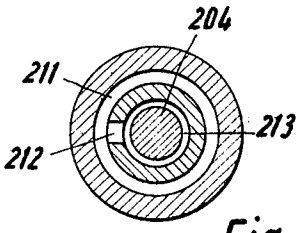

Fig. 13

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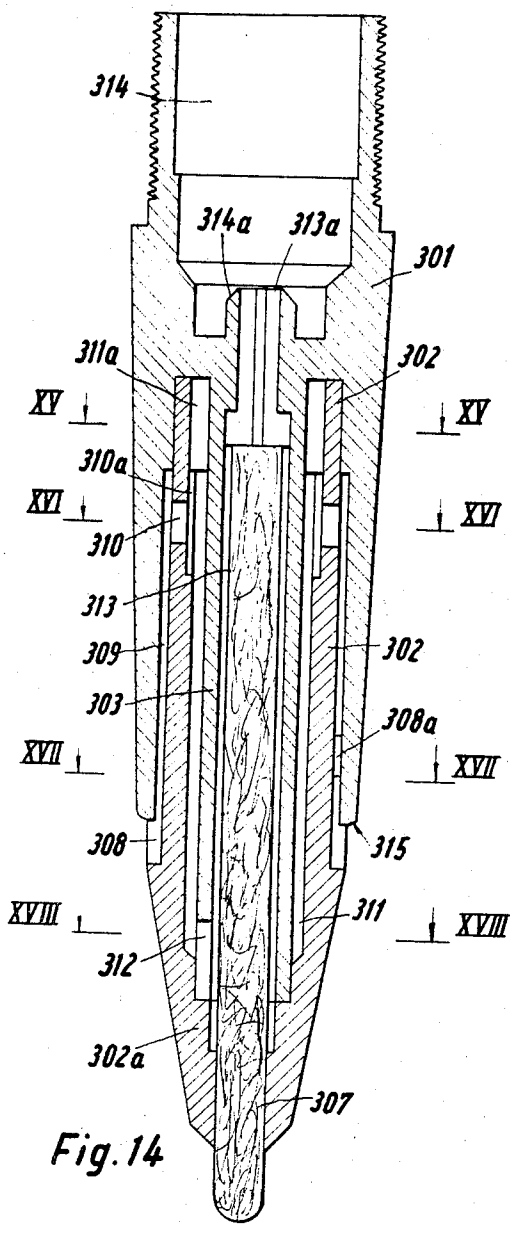

Fig. 14

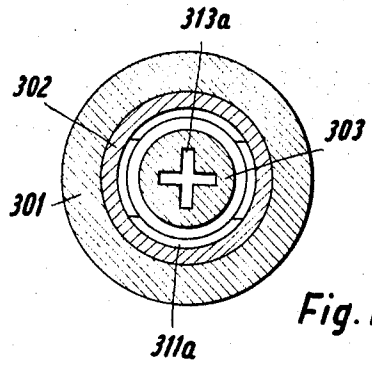

Fig. 15

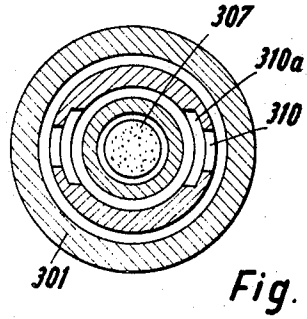

Fig. 16

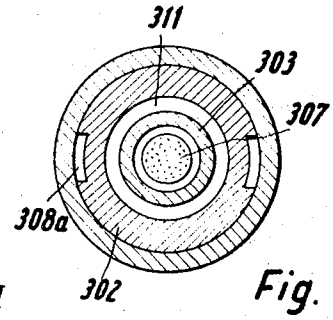

Fig. 17

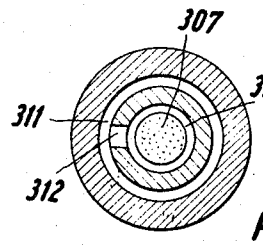

Fig. 18

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FOUNTAIN PEN

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Claims priority, application Germany, Aug. 12, 1965, H 56,843; Jan. 19, 1966, H 58,276
Int. Cl. B43k 1/10, 1/06, 5/16
U.S. Cl. 401—259 9 Claims

ABSTRACT OF THE DISCLOSURE

A fountain pen for a cartridge ink supply includes two annular capillary chambers surrounding the ink supply conduit, these two chambers providing communication between the ink supply and atmosphere through openings disposed at successive alternate ends of the respective passages thereby preventing leakage of ink.

It is a principal object of the invention to improve, in cartridge carrying fountain pens provided with central writing tip, the security against leakage and the uniformity of the flow of the writing fluid.

Another object of the invention is to provide a fountain pen of the character described of simplified construction.

Further objects of the invention will be apparent from the following description and claims.

In accordance with the present invention, the channel for the writing fluid, which is coaxial with the writing tip, is defined by a closed ink supply and air admission tube which extends from the cartridge chamber to a point close to the section securing the writing tip. The tube has only at its lower end at least one inner air inlet opening which communicates with the outer air inlet provided at the side of the fountain pen behind the head member.

Due to this arrangement, the rear chamber for the cartridge communicates, on the one hand, with the writing tip and, on the other hand, with the outer air inlet for the compensating air solely by means of an elongated tube; thereby, the point of the air inlet for the compensating air into the tube is at lower end of the tube which extends close to the supporting point of the writing tip. In this way, the boundary surface between the compensating air and the writing fluid flow and at the same time prevent securely that an excess of ink flows out of the writing tip. Particularly, it has been found that such arrangement provides for complete positional independence, i.e. the ink flow is independent of the inclination of the fountain pen with respect to the writing surface or with respect to the vertical.

In order to prevent that, at variations of the temperature or pressure, writing fluid flowing in excess to the writing tip interferes with uniform writing flow, it is of advantage to arrange a capillary ink compensator chamber about parallel to the air admission and ink supply tube in such a way that the lower end of the compensator chamber communicates with the inner air admission opening at the lower end of the tube while the upper end of said compensator chamber connects to the vent at the outside of the fountain pen behind the head member. In this way, excess writing fluid is ensured to be taken up in the compensator chamber and to be returned, when needed, to the ink channel, without the risk that on shaking, or the like, writing fluid can flow to the outside from the compensator chamber through the vent. Neither is there the risk that liquid droplets can settle in the compensator chamber since the boundary between compensation air and liquid takes up always a definite position inside the compensator chamber or at

the level of the vent at the lower end of the air admission tube or ink effluent tube.

It is of advantage to form writing fluid channel, compensator chamber, and an air channel connecting the chamber with the vent, as concentrical annular chambers. For this purpose, there is provided a sleeve member which surrounds the air admission and ink effluent tube at an appreciable radical distance and itself is surrounded at its outer side by a radially spaced sleeve-shaped section of the forward portion of the fountain pen.

The annular spaces communicate advantageously through bores in the sleeve-shaped section in the rearward portion thereof. Behind the bores, the compensator chamber is followed with advantage by a cross-sectionally enlarged collecting chamber for excess writing fluid which collecting chamber returns the excess to the capillary compensator chamber. This increases the leakproofness.

The simple design of the novel fountain pen can be further considerably improved by making the sleeve-shaped section integral with the head member supporting the writing tip and by providing for slidable insertion of the component into the forward portion, which consists of the outer sleeve portion and the air admission and ink effluent tube integrally connected therewith through the transverse wall. For assemblage, the two components need only be telescoped into each other; thereby, a friction fit may be provided in the area of the transverse wall between the rear end of the sleeve section of the head member and the forward portion.

As the writing fluid and the compensating air flow counter-currently in the ink channel, there might occur in some cases difficulties due to the capillary forces. Such difficulties can be prevented in a simple manner by enlarging the ink channel at a limited area of its periphery asymmetrically. Advantageously, such expansion may consist in a one-sided flattening or in an open groove at one side of the ink supply rod, which are open towards the end of said rod. It is practical to have such enlargement of the cross-section extend over the entire length of the ink channel to the level of the vents at the lower end of the air supply and ink effluent tube.

The present invention will be more fully understood from the following description of the accompanying drawings which disclose diagrammatically various embodiments of the invention; however, the drawings are not intended to limit the invention to the structures shown which are presented to serve for explanatory purposes only.

In the drawings,

FIG. 1 is a longitudinal view of the lower portion of a fountain pen according to the invention, carrying a cartridge (not shown);

FIGS. 2–4 are sectional views taken on lines II—II, III—III, and IV—IV, respectively, at different levels of said lower portion;

FIGS. 5–8, FIGS. 9–13, and FIGS. 14–18 correspond to FIGS. 1–4 but show modified embodiments of the invention.

In the drawings, only the forward portion of the fountain pens is represented, which is the only part of interest for understanding the invention. The drawings do not show the cartridge which can be disposed in known manner in a upper chamber of the forward portion.

The fountain pen of FIGS. 1 to 4 has a forward portion **1** in form of a sleeve whose front end is closed by a head member **1***a*. Between the sleeve portion **1** and the head portion **1***a*, there is provided a transition shoulder **15** which is preferably beveled and serves to coact with a closure cap, when the fountain pen is not used, and to ensure a seal.

In the head member, the central writing tip in form of a writing tube **7** is supported. In the sleeve-shaped forward portion **1**, there is inserted an air admission and ink effluent tube **3** coaxially to the writing tip **7** and a fluid seal against the sleeve is obtained by a collar **3***b* at the rear portion of tube **3**. The collar **3***b* separates a rear chamber **14** for the cartridge from an annular chamber provided within the sleeve-shaped portion **1**.

As seen in FIG. 1, the air admission tube **3** extends from the collar **3***b* far downwardly close to the head member **1***a*. At its front end, the tube is open and in the example shown, is in fluid-tight contact with a shoulder of a sleeve member **2** inserted in the annular chamber. The forward constricted head portion of sleeve member **2** engages a bore of the head member **1***a* and is supported therein sealing relationship. The sleeve portion **2** surrounds the ink effluent tube **3** at a radial distance sufficient to form a compensation chamber **11**. The compensation chamber communicates with the ink channel **13** inside the ink effluent tube through inner vents **12** which are provided at the lower end, i.e. close to the head member **1***a*, in the air admission and ink effluent tube **3**. As the figures show, the compensation chamber **11** extends to the collar **3***b* of the tube.

At its rear end, the sleeve-shaped insert **2** has a collar **2***a* which engages with frictional fit the sleeve-shaped forward portion **1** in such a way as to have the portion surround the sleeve-shaped insert **2** over an essential part of its length at a radial distance. In this way, an outer annular chamber **9** is formed which advantageously has a considerably smaller radial cross-section than the inner compensator chamber **11**.

The outer annular chamber is a communicating channel between apertures **10** in the rearward half of the sleeve-shaped insert **2** and an outer air inlet provided at the periphery of the forward portion **1** behind the head member **1***a*. It is of advantage to arrange the air inlet **8**, which may consist of a plurality of circumferentially distributed openings, between the head piece **1***a* and the sealing shoulder **15**.

It will be seen that the ink channel **13** communicates with the atmosphere by means of the bore **12**, the compensator chamber **11**, the bore **10**, the communicating channel **9**, and the air inlet **8**. Excess liquid can enter the compensator chamber **11** through the air admission aperture **12** and is collected therein in rather large amounts. Thereby, the liquid can rise to the upper end **11***a* of said chamber. As a rule, it is unlikely in practice that the liquid overflows through the bore **10** outwardly into the narrow annular space **9**. But even if this should be the case, there remains a well defined boundary between the liquid and the air. If in an exceptional case, liquid particles should get stuck in the annular channel **9**, the compensating air will always find a way from the air inlet **8** to the compensator chamber and from the chamber to the ink channel **13**. When the air-liquid boundary is near the air inlet aperture **12**, fine air particles, if needed, will separate from the air column and enter through channel **13** upwardly into the cartridge chamber; in this case, the capillary forces and tensions controlling the ink flow become effective at said boundary area, i.e. at a point very close to the writing tip **7**. This has a very strong equalizing effect on the ink flow.

In the example shown, the ink channel **13** is limited at its inside by an ink supply rod **4** which is received in the tube **3** with radial play and is to a certain extent axially displaceable therein. The ink supply rod **4** can be connected, through a connecting member **5**, to a needle **6** which projects through the writing tube **7**. At its rear end, said ink supply tube is provided, behind the flange **3***b*, with a constricted transfer section **3***a*, into which a correspondingly constricted end section **4***a* of the ink supply rod enters. The section **4***a* ensures an undisturbed passage of the writing fluid from the cartridge chamber into the ink channel.

In order to facilitate the passage of the liquid into the ink channel, the ink supply rod is preferably provided with a one-sided groove **4***b* which is open towards the end of the rod and which is open also radially outwardly in the direction of the ink channel. This chamfer or groove limits the cross-section of the ink channel in circumferential direction and widens it locally, which has a very favorable influence on the countercurrents of writing fluid and compensating air. In the example shown, the groove **4***b* extends only over part of the ink supply rod. However, it may be of advantage, as shown in FIG. 5, to extend the groove over the entire length of the ink supply rod. Such a design prevents the upwardly flowing compensation air to interfere with the axial movement of the ink supply rod or prevents the capillary tensions from braking said rod.

The dimensions of the cross sections of the bores **10** are rather large to ensure the passage of the compensating air. It is also possible to distribute several air inlet openings **12** and several air inlets **8** in the direction of the periphery as shown for the air inlets **8** in dotted lines in FIG. 4.

The embodiment of the invention shown in FIGS. 5 to 8 is distinguished from that of FIGS. 1 to 4 essentially by a full length groove **104** in the ink rod and by the use of a fibrous writing stylus **107** as central writing tip, which is held in the head piece **101***a* by means of a sleeve. In this case, the writing stylus **107** is not connected to the ink supply rod **104** so that the rod is axially displaceable independently of the writing tip. Otherwise, the construction of the fountain pen of FIGS. 5 to 8 is the same as that of the fountain pen of FIGS. 1–4. Corresponding parts have been designated by the same reference numerals, increased by 100.

FIGS. 9 to 18 show two other embodiments of the invention which differ from the embodiments illustrated in FIGS. 1 to 8 essentially by simpler construction and by a still more favorable effect of the control of the ink flow.

In the embodiment illustrated in FIGS. 9 to 13, there is provided a sleeve-shaped forward portion **201** which comprises a rear section for forming a cartridge chamber **214** and a front section which is open at its forward end. The front edge of the sleeve-shaped forward portion forms at **215** a sealing shoulder which cooperates with a corresponding closure cap (not shown) so as to seal the forward portion in the closed state towards the outside. Approximately at its middle, the forward portion has at its inside a partition **203***b* which connects it to a central air admission and ink effluent tube **203**. The tube is open at its ends and projects with its front end considerably beyond the front edge **215** of the sleeve-shaped forward portion in axial direction. At the end, the tube has at least one lateral perforation.

Between the sleeve portion **201** and the air admission and ink effluent tube **203** concentrically arranged thereto, which are joined to a unitary structure by means of the transverse wall **203***b*, there is formed an annular concentric chamber which is open towards the front end and closed at the rear by the transverse wall **203***b*. The cartridge chamber **214** is hermetically sealed from the annular front chamber by the transverse wall **203***b*.

In the illustrated example, the head member **202***a* is independent of the forward portion **201** and supports, as in the embodiment of FIGS. 1 to 8, the central writing element, which in the example is constituted by a writing tube **206**. At the rear of the head member **202***a* and integrally united therewith, there is provided a coaxial sleeve section **202** which extends over the same length as the air admission and ink effluent tube **203** and which is open at its rearward end. The end of the sleeve section is seated with friction fit into the sleeve portion **201** or in a corresponding contraction of the cross section, and held therein. The sleeve section **202** of the head member **202***a* has a central bore which extends far into the head member and serves to receive the air admission and ink effluent tube **202**. The front end of the tube is inserted fluid-tight into

a recess of the head member while otherwise the outer periphery of the tube and the inner periphery of the sleeve section **202** are clearly radially spaced from each other so as to define between themselves in the assembled state of the fountain pen an enlongated annular compensator chamber which communicates with the ink channel **213** through the perforation **212** at the lower end of the ink effluent tube **203**. At its rear end adjoining the transverse wall **203***b*, the compensator chamber is radially widened by a recess in the sleeve section **202**, whereby this portion serves as collecting chamber **211***a*.

The sleeve section **202** is seated in the forward portion **201** in radially spaced relationship so as to define an annular connecting channel **209**. The radial dimension of the channel **209** is considerably smaller than that of the compensator chamber **211**. At its rear portion, the sleeve section **202** of the head member **202***a* has one or more radial bores **210** of relatively large diameter which connect the compensator chamber **211** with the connecting channel **209**. As indicated at **210***a*, the cross section of the bores **210** is considerably enlarged at the side facing the compensator chamber **211**. These enlargements communicate with the collecting chamber **211***a*.

The annular connecting channel **209** terminates at its lower end into axially extending slots or recesses **208***a*, which in assembled state of the fountain pen project down to below the lower edge **215** of the sleeve-shaped forward portion **201**. In this way, there are formed between the lower edge **215** and the head member air inlets, which have a very small cross section and terminate behind the head member **202***a* at the outside of the forward portion. The compensating air can enter through vents **208** and passes through the channel **209**, bores **210**, compensator chamber **211**, and air inlet openings **212** into the ink channel **213**.

A comparison between the embodiment of the invention according to FIGS. 9 to 13 with that of FIGS. 1 to 8 shows that the air inlet opening **212** and therewith the normal boundary between liquid and compensation air in the embodiment of FIG. 9 is located considerably closer to the writing tip than in the embodiment of FIG. 1. It will be seen that the air inlet opening **212** is even considerably lower, i.e. closer to the tip, than the vent **208**.

The air inlet and ink supply tube **203** has also a cylindrical extension **203***a* of reduced cross-section which projects into the cartridge chamber **214** and which receives a constricted section **204***a* of an ink supply rod **204** which is axially displaceably disposed in tube **203**. Rod **204** is grooved or chamfered over its entire length at **204***b*. In addition, the ink supply rod carries at its lower end a needle **205**, which projects into the writing tube **206**.

The embodiment of the invention according to FIGS. 14 to 18 is distinguished from that of FIGS. 9 to 13 essentially by providing a central fibrous writing tip **307** as central writing point which projects far into the air admission and ink supply tube **303**. In addition, in the transition section **303***a* between ink channel **313** and cartridge chamber **314**, the cross-section is cruciform, as best shown in FIG. 15 which is designated **313***a*. The writing tip in the form of a fibrous or felt writing point is held in the head member **302***a*, whereby the ink channel and the air admission and ink feed tube **302**, which defines the outer wall of the channel, projects far into the head member **302***a* and whereby the vent **312** is located very close to the writing tip.

Otherwise, the construction is substantially the same as in the embodiment of FIGS. 9 to 13. The same reference numerals are used for similar parts except that the first digit has been changed from "2" to "3."

The construction ensures that the compensator chamber is correctly filled with the writing fluid and emptied without formation of air occlusions or ink residues in the chamber. The excess ink enters from the ink channel through the air inlet opening into the compensator chamber from the front side and fills it flowing from the front side to the rear side, whereby the air present in the chamber can escape from the rear side of the chamber. Even if the fountain pen is subjected to shocks or jarrings, the excess ink does not pass into the channel which communicates with the atmosphere.

The venting of the chamber is ensured at all times. Conversely, no ink residue can remain when the ink is consumed or the excess ink is drawn back because any such residues close the vent until the last moment.

The assemblage of the two last described embodiments is particularly simple, and the components are readily made by injection molding. The components are simply assembled by fitting them into each other whereby no securing means are required. The very low location of the vent at the lower end of the air inlet and ink supply tube in the last described embodiments assures a completely homogenous ink flow even under adverse conditions.

The collecting chamber provided in back of the bore **10** or **210** can easily be dimensioned large enough to catch the entire ink excess when the fountain pen is carried in the pocket in reverse position so that no ink can enter the outer air connection channel.

The air inlet opening **12** or **212**, located close to the writing tip, has an always uniform high capillary potential which is independent of the position of the fountain pen or of its inclination with respect to the vertical.

A further advantage of the novel fountain pen is that the parts can be assembled in any position, i.e. no particular attention need be given to make sure that the parts have a predetermined peripheral position with respect to each other.

We claim:

1. In fountain pens of the character wherein an elongated sleeve portion is provided with a writing tip at one end and means is provided at the other end to receive an ink supply cartridge, the combination including a central ink supply conduit connecting an ink supply cartridge with the writing tip, an inner annular capillary chamber surrounding said conduit within the sleeve and an outer annular capillary chamber surrounding the inner capillary chamber within the sleeve, said inner capillary chamber being in communication with the ink supply conduit only at the end adjacent the writing tip, the inner and outer capillary chambers being in communication with each other only at a location further from the writing tip, the outer capillary chamber being in communication with the atmosphere at a location adjacent the writing tip.

2. The invention defined in claim **1**, wherein said inner and outer annular chambers are defined by annular unitary elements having a radial flange at one end for functional sealing engagement with the interior of the elongated sleeve.

3. The invention defined in claim **2**, wherein said ink supply conduit is composed of an annular unitary element, one end of said element being frictionally received in sealing engagement with one end of said first mentioned annular element.

4. The invention defined in claim **3**, wherein said annular element composing the ink supply conduit is provided with a radial flange at its other end for frictional sealing engagement with the interior of said elongated sleeve.

5. The invention defined in claim **4**, wherein said radial flange of the element composing the ink supply conduit is provided with an inwardly tapered seat for operative engagement with an ink cartridge.

6. The invention defined in claim **5**, wherein an ink supply rod is axially displaceably received within said ink supply conduit for defining with said conduit an annular capillary passage, a portion of the length of said rod having a recessed groove communicating with an ink cartridge.

7. The invention defined in claim 1, wherein said inner annular capillary chamber has a larger cross-sectional area at the location where it is in communication with the outer capillary chamber in order to catch any excess ink.

8. The invention defined in claim 1, wherein said elongated sleeve is provided with an exterior shoulder to receive a closure cap, and is provided with an opening therethrough positioned forwardly of said shoulder for said communication between the outer capillary chamber and the atmosphere.

9. The invention defined in claim 1, wherein said writing tip comprises a fibrous tip.

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LAWRENCE CHARLES, *Primary Examiner.*

U.S. Cl. X.R.

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