Jan. 17, 1939. R. NAMIKI 2,144,296

FOUNTAIN PEN

Filed Feb. 25, 1938 2 Sheets-Sheet 1

Fig. 1.

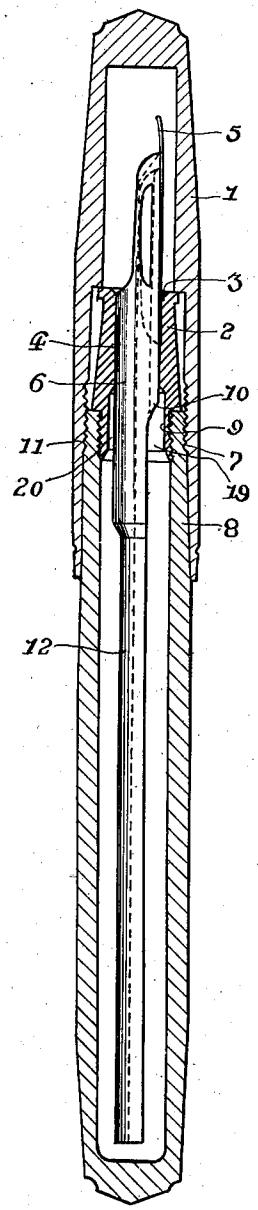
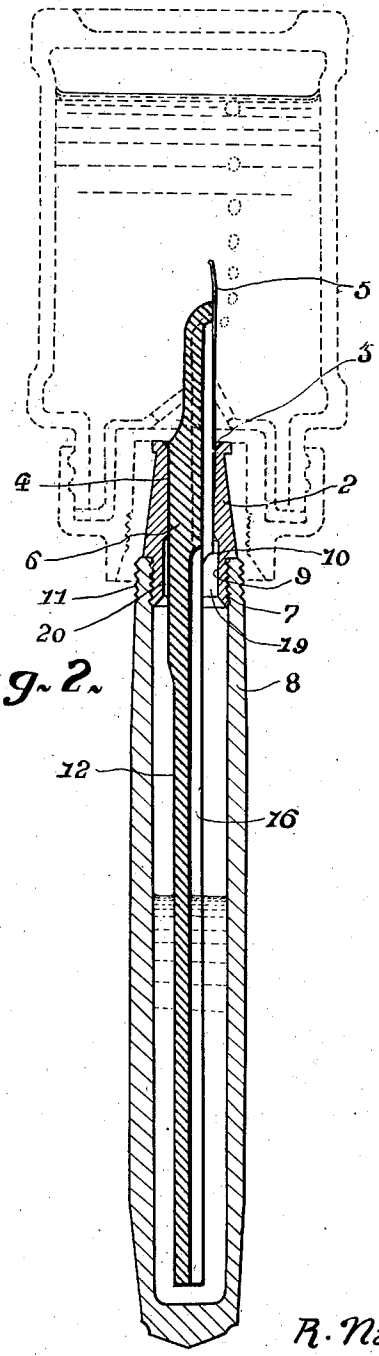


Fig. 2.



INVENTOR,
R. Namiki

BY:
Glascock Downing & Seebold
ATTORNEYS.

Jan. 17, 1939. R. NAMIKI 2,144,296

FOUNTAIN PEN

Filed Feb. 25, 1938 2 Sheets-Sheet 2

Fig. 3.

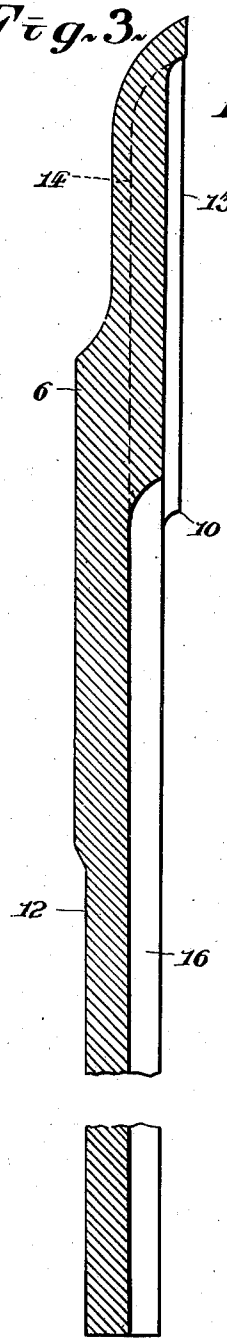


Fig. 4.

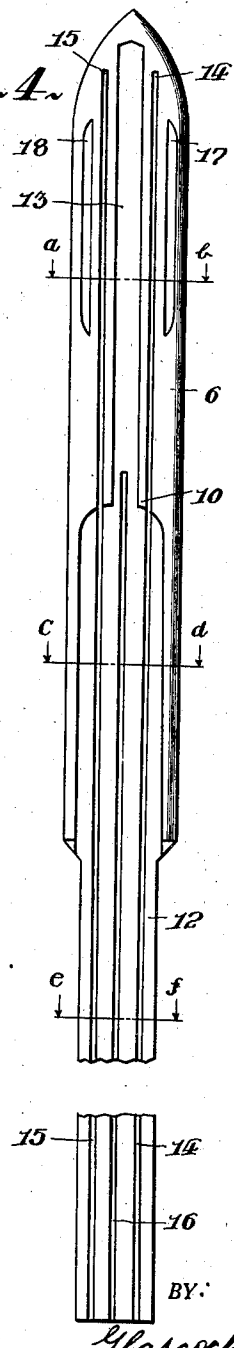


Fig. 5.

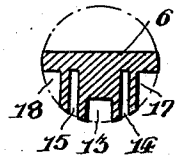


Fig. 6.

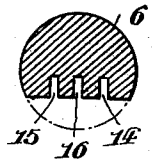
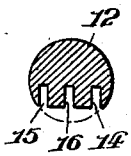


Fig. 7.



INVENTOR,
R. Namiki

BY:
Glascock Downing & Seebold
ATTORNEYS.

Patented Jan. 17, 1939 2,144,296

UNITED STATES PATENT OFFICE

2,144,296

FOUNTAIN PEN

Ryosuke Namiki, Takinogawa-ku, Tokyo-Shi, Japan

Application February 25, 1938, Serial No. 192,637

7 Claims. (Cl. 120—50)

This invention relates to improvements in or relating to fountain-pens of an automatic suction type, and has for its object to provide a fountain-pen of simple construction, and one which is not likely to be damaged or injured during a comparatively long period of use, thereby obviating the troublesome repairs of the fountain-pen.

A further object of the invention is to obtain a fountain-pen, in which any mechanical device, such as rubber sack or vacuum producing mechanism is not provided in the casing of the fountain-pen for the purpose of sucking ink, thereby increasing the quantity of ink to be sucked.

A further object of the invention is to obtain a fountain-pen, in which no weak material, such as soft rubber for sack, or leather, cork or rubber for forming soft valve, is used; in making of the casing such material as hard rubber or Celluloid or other similar semi-permanent material can be used, thereby increasing the durability of the fountain-pen, and notwithstanding the use of such material, enabling ink to be sucked automatically.

A further object of the invention is to obtain a practical and low-priced fountain-pen by making use of a physical action for sucking ink automatically, the action being solely governed by the construction itself of a combined feeding and filling bar, thereby entirely removing all manipulating mechanisms, such as complex pump mechanism, twist mechanism, or the like.

A further object of the invention is to offer a fountain-pen, in which ink is sucked automatically by simply inserting the top of the fountain-pen in an opening formed in the stopper of an ink-bottle, and then by turning the whole upside down. By this means, it is made unnecessary that as in ordinary fountain-pens, the top of the fountain-pen is wholly immersed into ink, and therefore, no trouble is needed to wipe off the ink adhering to the said top, after having sucked ink. Further, ink can be filled in a quantity of 100%, leaving no air space in the casing. In addition, it is possible that the last drop of ink remaining in the bottle is sucked for use. Still further, it is unnecessary that as in ordinary fountain-pens, ink remaining in the casing must once be emptied for effecting the second-time sucking. According to the invention ink can be replenished simply at any time and place.

A further object of the invention is to offer a fountain-pen, in which, as stated above, a physical action solely governed by the construction of a combined feeding and filling bar is utilized for sucking ink automatically, thereby making it unnecessary to use such special pressure or vacuum producing device as used in the ordinary fountain-pen. Further, by this means the defect can be avoided that ink is liable to leak or drop.

A further object of the invention is to offer a fountain-pen, in which ink overflooded within the cap of the fountain-pen due to the fact that the fountain-pen is inversely positioned and subjected to shock during carrying in a hand bag or the like, or due to the fact that heat is conducted to expand air in the casing, can be returned back entirely into the casing by simply uprighting the fountain-pen for a short time (about ten seconds), prior to removing the cap. Then the cap can be unscrewed to use the fountain-pen very safely.

A further object of the invention is to offer a fountain-pen, in which, even if air remaining in the casing expands under heat conduction so as to make ink overflow and threaten to drop, this overflooded ink can safely be returned by suction again into the casing only by standing erect the fountain-pen for a short time (about several seconds). In such a case, there has been no possible way in the ordinary fountain-pen, except that the overflooded ink is cast out by shaking, or wiped off by means of blotting paper or the like.

A further object of the invention is to obtain a fountain-pen, in which any ink which overflows in the nib-carrier during carrying can be returned entirely into the casing, and fresh ink can flow when using the fountain-pen; as a result, ink flows in constant density, thereby assuring the brilliancy of letters. In the ordinary fountain-pen, the ink once conveyed to the ink-ductor can never be returned into the casing, and therefore, the ink adhered to the ink-ductor is, during carrying, oxidized and turned black, thereby preventing fresh ink to flow until after the oxidized ink has been used; as a result, ink is always written down with different density and shades.

A further object of the invention is to obtain a fountain-pen, in which ink is extraordinarily smoothly sucked throughout the whole sucking operation, without the need of shaking the fountain-pen, or giving thereto some other motion. In the known fountain-pens devised as in a similar way to the invention, ink is sucked very badly, resulting in that sucking must be interrupted in the beginning or the midway of the sucking operation; for this reason, it is needed

the fountain-pen is shaken, or some other motion is given thereto, so as to help suction.

Still other objects of the invention are explained referring to the drawings and made clear in the following explanation.

In order to attain the various objects as mentioned above, the invention can be best embodied in the following way: The casing is in the form of a cylindrical barrel having one end closed and provided with external and internal threads at its opened end. It is unnecessary to provide the casing with any other means. With the internal threads is screwed a nib-carrier, and with the external threads a cap. The nib-carrier has a bore, and the bore is formed with a recess of slightly greater internal diameter than that of the bore, extending downwardly a suitable distance from the edge surface of the threaded portion of the nib-carrier. Inserted in the bore there are a pen and the novel combined feeding and filling bar. The bar consists of a solid portion and an extension thereof. The solid portion is formed at its back (the surface intended for holding the pen) with a central air-groove extending axially. At the opposite sides of the air-groove there are arranged two ink-ducts one at each side, extending down to the lowermost end of the extension of the ink-ductor. The diameter of the extension is made as small as possible, compared with the solid portion. The bar is further formed with a cut off flat surface, at its back, extending along about one-half length of the solid portion and along the whole length of the extension. Intermediate between the two ink-ducts and parallel to them, there is an auxiliary ink-duct, extending from the lowermost end of the extension and projecting slightly beyond the lower extremity of the air-groove of the solid portion. The fountain-pen thus constructed is inserted in an opening formed in the stopper of an ink bottle, and the whole is turned upside down, then the ink of the bottle flows along the ink-ducts of the ink-ductor into the casing, while the air existing in the casing escapes in the form of bubbles through the heart hole of the pen into the bottle, until the ink gradually sucked fills up the casing. It is for this reason that ink can be sucked in the amount of 100%, without any use of mechanical suction device or any special pressure or vacuum producing device.

Referring to the drawings,

Fig. 1 is a longitudinal section of the fountain-pen constructed in accordance with the invention;

Fig. 2 is a longitudinal section of the same, illustrating the manner in which ink is sucked;

Fig. 3 is a longitudinal section of the combined feeding and filling bar, illustrating the depth, both of the air-groove and the ink-ducts formed therein, and also the contour of the cut off flat portion of the bar;

Fig. 4 is a plan of the feeding and filling bar, illustrating the positions for arranging the air-groove, ink-ducts, auxiliary ink-duct and crescent cavities;

Fig. 5 is a section along the line *a—b* of the exposed portion of the solid portion of the feeding and filling bar, illustrating the relative positions of air-groove, ink-ducts and crescent cavities;

Fig. 6 is a section along the line *c—d* of the cut off flat portion of the feeding and filling bar, illustrating ink-ducts and auxiliary ink-duct;

Fig. 7 is a section along the line *e—f* of the extension of the feeding and filling bar, illustrating ink-ducts and auxiliary ink-duct.

Throughout the drawings, the same reference numerals indicate the corresponding parts.

Now, referring to Fig. 1, the reference 1 indicates a cap, which may be of any known construction. The nib-carrier 2 is formed with a dish-like hole at its mouth, and has a central bore 4, intended for holding therein a pen 5 and a combined feeding and filling bar. The nib-carrier has a threaded portion 7 to be screwed with the corresponding threaded portion of the casing 8. The bore 4 is formed with a recess 9, the internal diameter of which is larger than that of the bore 4, and which extends internally from the lower edge of the bore. The internally extending distance should be, as shown, projecting slightly beyond the starting edge of the cut off flat portion 10. The reason why the recess 9 is especially disposed is explained later. The casing 8 is in the form of a cylindrical barrel having a closed bottom, with external threads 11 and internal threads 7, by which the nib-carrier 2 is screwed with the ink casing. The ink-ductor is characterized in that it is a comparatively long member consisting of a solid portion 6 and an extension 12 thereof. The lowermost end of the extension 12 extends near the closed bottom of the casing. The extension, however, can be made shorter if desired, but it should be noted that the extension shall be of somewhat considerable length as explained later. The length of the solid portion 6 is, as shown, such that it projects slightly beyond the lower edge of the nib-carrier. The extension 12 should be of a diameter as small as possible, so as to increase the quantity of ink to be sucked in the casing. The cut off flat portion formed in the back of the bar and extending along a part of the solid portion and the whole length of the extension, is for the purpose that, when sucking ink, the exchange of air for ink is made easy on the one hand, and on the other hand ink to be sucked is increased correspondingly. The said exchange is explained later. The cross sectional shape of the extension 12 may be either rectangular, square or circular, but generally circular is preferred in view of easy mechanical working thereof.

Now, the feeding and filling bar constructed in accordance with the invention is explained with reference to Figs. 3–7. The solid portion 6 is provided at its back with an air-groove 13 (see Figs. 3, 4 and 5), which terminates at the starting edge 10 of the cut off flat portion. The air-groove serves as a passage for air in the casing. The air, when ink is sucked, escapes upwardly towards the ink bottle. The air-groove also serves as a passage for the outside air, which tends to enter the casing during the use of the fountain-pen. In view of these functions of the air-groove, its section should be made comparatively greater than that of other ink-ducts, but should not be so excessively great that ink flows always excessively, so that blotting paper must be used successively. The sectional area of the air-groove should be below 0.5 square mm., so as to avoid the above mentioned defect. As stated above, the air-groove serves as a passage for air only. For this purpose the air-groove must be disposed separately from other ink-ducts. In known feed bars, the air-groove is formed at its bottom with two or three ink-ducts so that they are positioned in the same place. Such known air-groove should be abolished according to the

invention. The theoretical reason therefor is stated later on.

At the opposite sides of the air-groove 13, there are disposed ink-ducts 14 and 15, extending axially from near the top of the solid portion down to the lowermost end of the extension 12, and separated from the air-groove. The ink-ducts serve as passages for ink, which is sucked from the bottle into the casing, under the action of capillarity and gravity. The ink-ducts also serve as passages for ink, which flows, during the use of the fountain-pen, similarly under the action of capillarity and gravity. It is noted that the ink-ducts thus serve as passages for ink only, but not for any air. Therefore, they should be in section a rectangle of small width and great depth. Especially, the width should be considerably smaller than the depth or width of the air-groove. However, as explained later, the fountain-pen according to the invention depends in its ink suction considerably upon the gravity of ink, and therefore, it is noted that the ink-ducts have a width considerably greater than the known ink-ducts. This is for the reason that time required for sucking ink may be shortened as soon as possible. According to the experiments made by the inventor, it has been found that the width of the ink-ducts is preferably from 0.3 to 0.4 mm. The depth of the ink-ducts should be as great as possible.

Intermediate the ink-ducts 14 and 15, there is an auxiliary ink-duct 16 (see Figs. 3 and 4), extending from the lowermost end of the extension 12 up to and slightly projecting beyond the edge 10 of the air-groove. This auxiliary ink-duct 16 acts, when the air-groove 13 is for any reason filled up with ink as sucked, to force down said ink and remove it from the air-groove. In this way, the proper function of the air-groove is secured. When the fountain-pen is used, the auxiliary ink-duct serves to convey ink near the extremity 10 of the air-groove 13, and thus this portion is filled up with ink. This assures that the outside air is positively prevented from freely entering the casing. The reason why such means is adopted is as follows: In case of using the fountain-pen, if the air-groove is not filled with ink, and consequently in an open state, the outside air freely enters the casing, thereby giving rise to a danger that the ink in the casing drops along the ink-ducts 14 and 15. In the fountain-pen according to the invention, ink can be freely sucked in the casing, while the fountain-pen is used in such a way that ink can be prevented positively from dropping. This phenomena will be at one glance considered strange. However, it may be easily understood if one pays attention to the fact that the air-groove 13 is always in an open state in the sucking operation, while it is always in a state filled with ink during the use of the fountain-pen. And the reason why ink can flow continually during the use of the fountain-pen is as follows: As ink is absorbed by the paper surface, there occurs a slight vacuum in the casing, and therefore, the outside air tends to invade through the heart hole of pen into the casing, so as to compensate for the vacuum formed therein. This invasion is effected against the resistance of ink filling the air-groove 13. Thus, during the use of the fountain-pen there occurs first vacuum in the casing, and then the outside air invasion, the latter being caused so as to compensate for the vacuum, and these actions are repeated in continual succession, preventing ink-flow from being interrupted.

Near the upper end of the solid portion 6 of the combined feeding and filling bar, there may be disposed, two crescent cavities 17 and 18 at the opposite sides of the ink-ducts 14 and 15. These cavities serve as sub-reservoirs for the ink, which should happen to overflow due to the fact that the air in the casing expands by the heat of body when using the fountain-pen. Thus, these cavities serve to prevent the overflooded ink from dropping.

Referring to Fig. 2, ink can be sucked in accordance with the invention as follows: As shown, the top of the fountain-pen is inserted in the opening formed in the stopper of the ink-bottle, and the whole is turned upside down. Then, the ink-ducts 14 and 15 are subjected to the force of descending ink both by capillarity and gravity. This force permits ink to flow along the ink-ducts down to the lowermost end of the extension 12, and subsequently to drop. By this flow of ink, the level of the ink of the bottle is lowered, thereby decreasing the pressure in the bottle to a value smaller than the atmospheric pressure, while the pressure in the casing is increased up to a value greater than the atmospheric pressure. However, as these two pressures are in communication with each other through the intermediary of the air-groove 13, the air in the casing can escape through the air-groove 13 into the bottle, ascending through the latter in the form of bubbles.

In the above way, if ink is contained in the ink-ducts along their whole length, the force of descending ink under the action of capillarity is interrupted permanently, and thereafter, the force of descending ink by the action of gravity only acts continuously to convey down ink into the casing, until the latter is filled with ink completely, while air in the casing can escape gradually into the bottle as stated above.

The reason why the force of descending ink by the action of capillarity is interrupted in the above way after the ink-ducts have been filled with ink is as follows: It is known that a capillarity phenomena is one which occurs between the relative surfaces of two phases, one liquid and the other solid. Therefore, if the said relative surfaces disappear, there will be no reason that capillarity can occur. In the case in question, if the ink-ducts are filled with ink, the relative surfaces between them are vanished, and consequently, it is obvious that the force of descending ink by capillarity is stopped.

In sucking operation, if the air-groove 13 is not filled with ink and therefore, is an open state, the air in the casing can escape easily through the air-groove into the bottle regularly. This permits always the casing to be filled with ink completely. However, if the air-groove is once filled with ink, the air in the casing undergoes difficulty in escaping, with the result that air bubbles can occur very irregularly, or sometimes can occur in no way, thereby making impossible that the casing is filled with ink completely. This phenomena is called "respiring phenomena". For avoiding this phenomena, it is indispensable that the passage for ink and that for air are arranged completely separated from each other. That is, the two passages should not be positioned in the same housing. This is the reason why in the invention the air-groove 13 is centrally disposed, and separated therefrom, there are disposed the ink-ducts 14 and 15, at the opposite sides of the air-groove.

The air in the casing can not escape into the

bottle, before the difference between the pressures in the bottle and in the casing reaches a definite value. It is nothing but the force of descending ink, which can establish such a difference. It is therefore important that the force of descending ink is made as large as possible. The force of descending ink can, in turn, be increased depending on the force of descending ink by gravity. This is the reason why in the invention the ink-ducts formed in the bar is widened considerably greater than the known feed bars. In brief, in known fountain-pens, the idea has prevailed that capillarity should be regarded as of importance, whereas in the invention the idea is based on the fact that much importance should be attached to gravity.

In the foregoing has been described that there is disposed a recess 9 extending from the lower edge of the nib-carrier, and at the back of the feeding and filling bar, a cut off flat surface extending along the whole length of the extension and one part of the solid portion of the bar. In such arrangement, one also sees that there is a large space 19 within the recess 9 at the back of the bar, and also a comparatively narrow space 20 at the abdominal portion of the latter. This is seen clearly from Fig. 2. Due to the difference between the two spaces, ink tends, by its surface tension, to attach always near the narrow space 20. In additional, ink can not form a film near the wide space 19. This permits ink to gather more and more near the narrow space 20, and thus, ink can finally flow along the inner wall of the casing. It should be however noted that during this interval, ink is also flowing along the two ink-ducts and an auxiliary ink-duct. As stated above, the wide space 19 is always kept in an open state, and therefore, the air in the casing can easily escape through the air-groove 13, and through the heart hole of pen into the bottle. Thus, the previously mentioned "respiring phonemena" can be entirely eliminated.

As stated in the foregoing, the fountain-pen of the invention lays stress upon gravity, by making use of which ink is caused to descend and an automatic suction of ink is made possible, physically. It is obvious that the construction of the fountain-pen is very simple and compact.

The extension 12 of the bar is not always necessary to be so long as shown in the drawings, and if desired, may be of such length that ink is enabled to drop by gravity along the ink-ducts. In this latter case, the time required for sucking ink is somewhat retarded, but the capacity of ink to be sucked into the casing can further be increased.

I claim:

1. In a fountain pen, a combined feeding and filling bar comprising a solid portion and an integral longitudinal extension, the inner part of the solid portion and the entire extension being cut away to leave a flat surface, the solid portion being provided with an air groove which terminates at the cut-away portion and the solid portion and the extension being provided with at least one ink duct positioned to the side of the air groove and separated therefrom.

2. A fountain pen as claimed in claim 1, in which the extension is provided with an auxiliary ink duct which terminates at the inner end of the air groove.

3. A fountain pen including a barrel having a closed inner end, a nib carrier detachably mounted in the other end of the barrel provided with a central bore, the inner end of which is enlarged at the point where it communicates with the barrel, a combined feeding and filling bar including a solid portion and an extension, the solid portion being snugly fitted within the bore of the nib carrier and extending beyond the inner edge of the latter and into the barrel while the extension extends to a point near the closed bottom of the barrel, the inner part of the solid portion and the entire extension being cut away to leave a flat surface, the cut-off portion of the solid portion being short of the bore but positioned within the enlarged end of the bore, the solid portion of the bar being also provided with an air groove which terminates at the cut-away portion and further provided on opposite sides of the air groove with ink ducts which extend throughout the length of the extension and which are separate from the ink groove.

4. A fountain pen as claimed in claim 3, in which the innermost part of the solid portion and the extension are further provided with an auxiliary ink duct, one end of which is in communication with the inner end of the air groove.

5. A fountain pen as claimed in claim 3, in which the section of the air groove is made comparatively larger than that of the ink ducts but is kept below 0.5 square mm. so as to prevent ink from dropping when subjected to a slight shock.

6. A fountain pen as claimed in claim 3, in which each ink duct is in the shape of a rectangle of small width and substantially great depth.

7. A fountain pen as claimed in claim 3, in which the back of the feed bar at the solid portion is provided with crescent shaped extensions positioned exteriorly of the ink duct.

RYOSUKE NAMIKI.