United States Patent

[11] 3,614,247

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[33] **Japan**
[31] **43/107068 and 43/107069**

[54] **WRITING INSTRUMENT STRUCTURE**
9 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **401/199**
[51] **Int. Cl.** **B43k 8/00**
[50] **Field of Search** 401/196, 198, 199, 202, 258, 265

[56] **References Cited**
UNITED STATES PATENTS

3,113,336	12/1963	Langnickel	401/199
3,338,216	8/1967	Roller	401/265
3,421,823	1/1969	Matsumoto	401/199

Primary Examiner—Lawrence Charles
Attorneys—Robert E. Burns and Emmanuel J. Lobato

ABSTRACT: An improved nib for a writing instrument comprising a casing, an ink reservoir incased in the case, a nib holder rigidly engaged with a tip portion of the case and provided with an aperture for rigidly holding the nib. The nib of the present invention is provided with an inner capillary conduit having a lateral cross section of snowflake shape. The conduit of the nib is arranged along an axis thereof and a rear end thereof is inserted into the ink reservoir while a tip end portion thereof is extended outwards from the nib holder. The tip end portion of the nib is sharpened. Additional means for flowing ink from the ink reservoir to the tip of the nib, such as a plurality of outside capillary grooves etc. can be preferably applied to the nib.

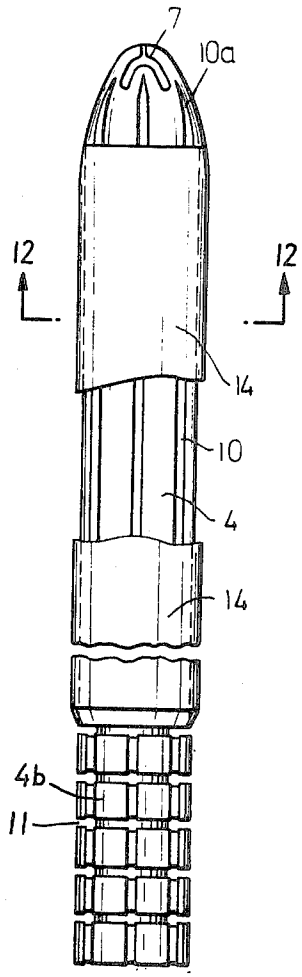


Fig. 1

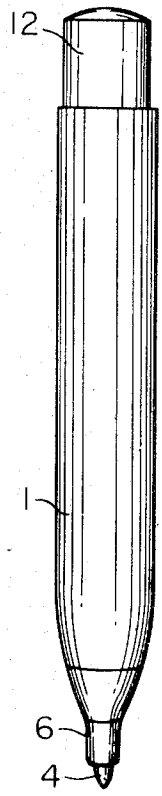


Fig. 2

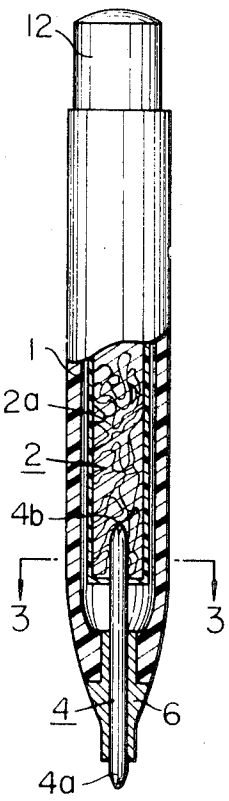


Fig. 4

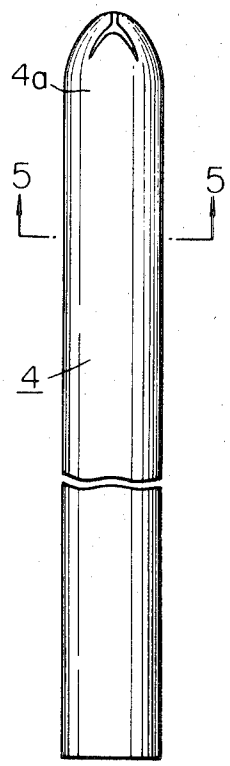


Fig. 6

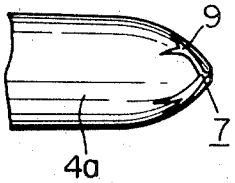


Fig. 3

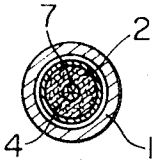


Fig. 5

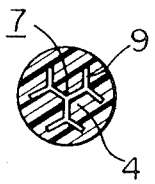


Fig. 7

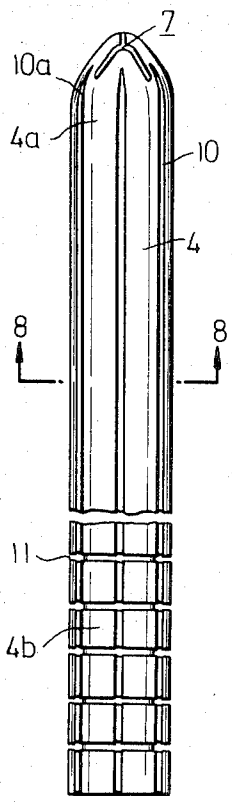


Fig. 9

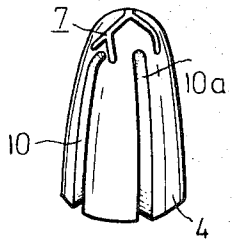


Fig. 10

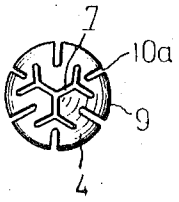


Fig. 12

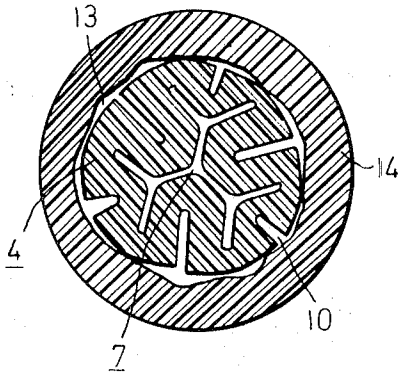


Fig. 8

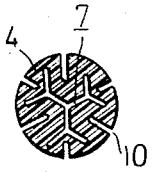
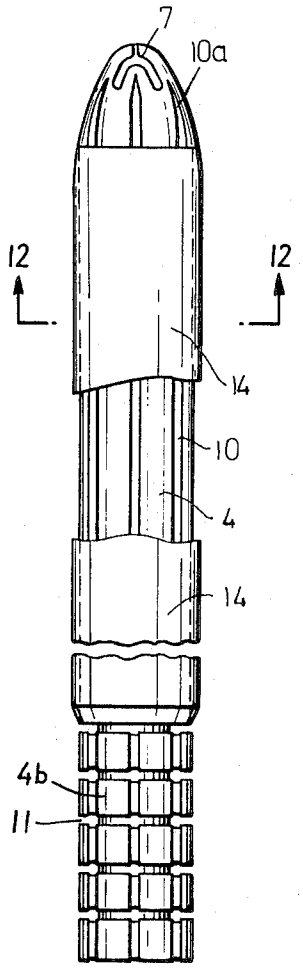


Fig. 11



WRITING INSTRUMENT STRUCTURE

The present invention relates to a writing instrument provided with an improved writing nib, more particularly with an improved writing wick nib of synthetic resin materials.

There is a general demand for a writing instrument provided with relatively smooth introduction of ink from a an ink reservoir to a nib of the writing instrument or to a pen in order to avoid such troubles as scratching during writing.

A principal object of the present invention is to provide a writing instrument which satisfies the above-mentioned demand.

Another object of the present invention is to provide a writing instrument characterized by a writing nib provided with an improved nib having superior capillary action to present smooth introduction of ink from the ink reservoir to the tip of the writing nib.

A further object of the present invention is to provide an improved writing instrument provided with a nib primarily made of thermoplastic synthetic resins.

In accordance with the above-described objects of the present invention, the writing instrument of the present invention comprises an ink reservoir housed in a cylindrical casing and a writing nib having improved capillary function and a nib holder rigidly secured to one end of the cylindrical casing. The rear end of the writing nib is inserted into an end portion of the ink reservoir and the tip end portion thereof extends out of a conically shaped end portion of the nib holder. The writing nib is principally provided with an inner capillary ink conduit axially formed throughout, which conduit is characterized by a lateral cross section having snowflake shape. Further, certain modifications such as a plurality of longitudinal capillary grooves formed on the peripheral surface thereof, or a plurality of annular grooves or spiral grooves transversely formed at the rear end portion thereof together with the longitudinal capillary grooves, may be additionally applied to the present nib as hereinafter illustrated.

In the case of applying the annular grooves or the spiral grooves together with the longitudinal capillary groove, the annular grooves or the spiral grooves are provided with a depth sufficient to intersect the outer capillary ink grooves and the outer portion of the inner capillary ink conduit. The inner capillary conduit terminates at the tip end of the nib, while the outer capillary grooves preferably terminate at the starting position of the tip end of the nib. The tip portion of the nib has a conical shape provided with a sharp point. Further, both the inner capillary conduit and the outer capillary grooves terminate at the rear end of the nib. The rear-end portion of the writing nib is inserted into the ink reservoir. Therefore, ink contained in the reservoir is introduced into the inner conduit through its terminal and the annular grooves or spiral grooves, and into the outer grooves through their terminals, also through the annular grooves or spiral grooves, and then the ink flows towards the tip portion of the nib where the above-described two flows of ink are combined.

In case of additionally applying only the above-mentioned longitudinal capillary grooves to the present writing wick, the same relation between the inner capillary ink conduit and the longitudinal capillary grooves as that mentioned above can be applied.

Further features and advantages of the present invention will be apparent from the ensuing description, reference being made to the accompanying drawings.

FIG. 1 is a side elevational view of a writing instrument of the present invention,

FIG. 2 is a side view, partly in section, of the writing instrument, shown in FIG. 1,

FIG. 3 is a cross-sectional view of the writing instrument, taken along line 3—3 in FIG. 2,

FIG. 4 is a partial enlarged side elevational view of a writing nib used for the writing instrument shown in FIG. 1,

FIG. 5 is a cross-sectional view of the writing nib taken along line 5—5 in FIG. 4,

FIG. 6 is a perspective of a tip portion of the writing nib shown in FIG. 4,

FIG. 7 is a partial enlarged side elevational view of a modified writing nib according to the present invention,

FIG. 8 is a cross-sectional view of the writing nib taken along line 8—8 in FIG. 7,

FIG. 9 is a perspective view of a tip portion of the writing nib shown in FIG. 7

FIG. 10 is a front view of the writing nib shown in FIG. 7,

FIG. 11 is an enlarged partial side elevational view of another embodiment of writing nib according to the present invention,

FIG. 12 is an enlarged cross-sectional view of the writing instrument taken along a line 12—12, in FIG. 11.

Referring to FIGS. 1, 2, 3, 4 and 5, a writing instrument of the present invention comprising an ink reservoir 2 housed in a cylindrical casing 1 and a writing nib 4 having improved capillary function and a nib holder 6 mounted at one end of the cylindrical casing 1. The rear end of the writing nib 4 is inserted into an end portion of the ink reservoir 2 and the tip end portion thereof extends out of a conically shaped end portion of the nib holder 6, the writing nib 4 is made of a certain thermoplastic synthetic resin and is provided with an inner capillary conduit 7, formed axially through the writing nib 4. The inner capillary conduit 7 has a snowflake cross section having a plurality of branches 8 each of which again branches to form diverging branch legs 9. The dimension of each branch 8 and each branch leg 9 of the cross section is so thin as to present an effective capillary action for introducing ink throughout (see (FIG. 5). For example, it is preferably to use a snowflake-shape cross section having the thickness of each branch leg in a range approximately between 0.02 and 0.04 mm. A tip portion 4*a* of the writing nib 4 is formed into a conically sharpened shape with a sharp point, which, for example, can be obtained by a grinding operation. Therefore, the inner capillary conduit 7 is emerged to the outside surface of the nib 4, as shown in FIGS. 4 and 6. It has been found that, as the dimension of each branch leg 9 of the nib 4 is to thin and the total lateral cross-sectional area of the inner capillary conduit 7 is sufficiently large for smooth flowing of ink from the ink reservoir 2 to the tip of the writing nib 4, that the principal object of the present invention can be attained very satisfactory. Further a rear-end tip portion 4*b* of the nib 4 may be sharpened by the same manner as the tip portion 4*a*.

The ink reservoir 2 includes a cylindrical fibrous block 2*a* reserving ink. The ink reservoir 2 is inserted into the cylindrical casing 1 through a rear-end aperture of the casing 1. After completion of the insertion of the ink reservoir 2 into the casing 1, a cap 12 is attached to the rear end of the casing 1 for closing the aperture.

Referring to FIGS. 7, 8, 9 and 10, showing a modified writing nib according to the present invention, the nib 4 is additionally provided with outer capillary grooves 10 formed on the periphery of the writing nib 4 in a longitudinal arrangement along the axis thereof, beside the above-mentioned inner capillary conduit 7. And a plurality of annular grooves 11 are further formed at an adjacent portion of the rear end 4*b* of the writing nib 4 with adequate intervening spaces. The tip portion of the writing nib 4 is formed into a conically sharpened shape with a sharp point, therefore, the outer capillary grooves 10 gradually terminate at a starting portion of the tip portion 4*a* of the writing nib 4, that is, the front termination 10*a* does not extend to the termination of the tip portion 4*a* itself as clearly shown in FIGS. 7 and 9.

Further, the annular grooves 11 are provided with sufficient depth to intersect with the outer capillary grooves 10 and the outer portion of the inner capillary ink conduit 7.

As is shown in FIG. 1, the rear-end portion 4*b* of the writing nib 4 is inserted into an ink reservoir 2 incased in a cylindrical casing 1 while the tip portion 4*a* of the writing nib 4 extends out of the nib holder 6.

By the above-mentioned engagement of the ink reservoir 2 with the nib 4, ink contained in the ink reservoir 2 is introduced to the inner capillary conduit 7 through its termination and the annular grooves 11, and to the outer capillary

grooves 10 through their terminations and the annular grooves 11 because of their capillary actions, respectively.

Consequently, with consumption of ink through the tip portion 4a of the nib 4 due to use of the writing instrument, continuous supply of ink is assured by the flow of ink through the inner capillary conduit 7 and the outer capillary grooves 10 of the writing nib 4. In this capillary introduction of ink through these paths 7 and 10, both flows of ink combine with one another at the termination 10a of the outer capillary grooves 10. Thus, a smooth supply of ink can be assured throughout the writing operation.

By our repeated tests of the above-mentioned writing nib 4, even in cases of very fine writing, no problems such as scratching, was noticed and a considerably uniform supply of ink was observed. Further, the combination of the thin branches 9 of the inner capillary conduit 7 and the other capillary grooves 10 together with the annular grooves 11 provide sufficient capillary action of the writing nib 4 of the present invention.

According to our further research, it has been found that the annular grooves 11 of the above-mentioned embodiment may be omitted without bad influence of the flowing ink.

It has been also found that, as shown in FIG. 11 a writing nib additionally provided with a sheath cylindrically holding the above-mentioned writing nib 4 of the second embodiment shown in FIG. 7 is also useful to attain the purpose of the present invention. The cross-sectional shape of this writing nib is clearly shown in FIG. 12, wherein, a cylindrical sheath 14 holds the above-mentioned writing nib 4 having the inner conduit 7 and the outer capillary grooves 10 as shown in the drawing so that a plurality of additional thin spaces 13 are provided at portions between an inside wall of the cylindrical sheath 14 and the outer surface of the above-mentioned nib 4. As the spaces 13 fully extend along the axis of the nib 4, further additional capillary conduits are formed.

Changing of the ink reservoir 2 after consumption of ink contained therein may be performed instantly and simply by substituting a fresh reservoir for the used one contained in the casing 1 in the manner described above, if it is necessary.

The above-described characteristic construction of the writing instrument, of the present invention, is not only limited in the above-mentioned disclosure and drawings, but any modification having the same function must be considered as in the scope of the present invention.

What is claimed is:

1. In a writing instrument comprising a casing having a rear end and a forward end, an ink reservoir in said casing, a writing nib having a rear end in said ink reservoir and a forward end projecting from the forward end of the casing, a nib holder rigidly holding said nib in the casing and having a tapered forward end portion, said nib having a tapered tip extending forwardly from the tapered forward end of said nib holder; the improvement that said nib comprises a core member having an axially extending inner capillary ink conduit having a lateral cross section of a snowflake shape comprising a plurality of main leg portions radiating from a central capillary channel, each of said main leg portions branching into a plurality of diverging branch leg portions, each of said main leg portions and said branch leg portions being defined by walls approximately uniformly spaced apart a distance to flow ink smoothly and uniformly therethrough by capillary action, said central channel terminating at the forward end of said tapered tip portion of the nib, said main leg portions opening in the sides of said tapered tip portion of the nib as slits radiating from the center of the tip and said branch leg portions opening in the sides of said tapered tip portion of the nib rearwardly of the forward end thereof, said inner capillary ink conduit terminating at its rear end in said ink reservoir, whereby ink contained in said ink reservoir is introduced from said ink reservoir into said inner capillary ink conduit and flows smoothly, continuously and uniformly through said central channel, said main leg portions and said branch leg portions of said conduit to the tip of said nib upon consumption of ink from the tip of the nib due to use of said writing instrument.

2. An improved writing instrument according to claim 1, wherein said writing nib is additionally provided with a plurality of outer longitudinal capillary ink grooves formed on a peripheral surface of said nib; said inner capillary ink conduit terminating at an end of said tip portion of said nib; said outer capillary ink grooves terminating at a starting position of said tip portion; said inner capillary ink conduit and outer capillary ink grooves terminating at the rear end of said nib whereby, said ink contained in said ink reservoir is introduced from said ink reservoir to said inner capillary ink conduit and said outer capillary ink grooves through their terminations, ink flowing smoothly and continuously to said tip of said nib through said inner capillary ink conduit and outer capillary ink grooves upon consumption of ink due to use of said instrument.

3. An improved writing instrument according to claim 2, wherein said writing nib is further provided with means for additionally introducing ink from said ink reservoir to said outer capillary ink grooves, said additional means being annularly formed on said nib at a position adjacent to said rear end of said nib, said additionally introducing ink means intersecting with said outer capillary ink grooves and an outer portion of said inner capillary ink conduit; whereby, said ink contained in said ink reservoir is introduced from said ink reservoir to said inner capillary ink conduit and said outer capillary ink grooves through their terminations, and further additionally introduced to said inner capillary ink conduit and outer capillary ink grooves through said additionally introducing ink means, ink flowing smoothly and continuously to said tip of said nib through said inner capillary ink conduit and outer capillary ink grooves upon consumption of ink due to use of said writing instrument.

4. An improved writing instrument according to claim 3, wherein, said additionally introducing ink means comprises a plurality of annular grooves formed annularly at said rear-end portion of said nib with intervening spaces between adjacent annular grooves and each of said annular grooves has a depth sufficient to intersect with said outer capillary ink grooves and an outer portion of said inner capillary ink conduit.

5. An improved writing instrument according to claim 3, wherein, said additionally introducing ink means comprises a spiral groove provided with a depth sufficient to intersect with said outer capillary ink grooves and an outer portion of said inner capillary ink conduit.

6. An improved writing instrument according to claim 1, wherein the thickness of the space of each said branch leg is defined in a range between 0.02 and 0.04 mm.

7. In a writing instrument comprising a casing having a rear end and a forward end, an ink reservoir in said casing, a writing nib having a rear end in said ink reservoir and a forward end projecting from the forward end of the casing, a nib holder rigidly holding said nib in the casing and having a tapered forward end portion, said nib having a sharpened tip extending forwardly from the tapered forward end of said nib holder; the improvement that said nib comprises a core member having an axially extending inner capillary ink conduit of a cross-sectional shape comprising a plurality of thin leg portions radiating from a central capillary channel, each of said leg portions defining a thin space for the smooth flow of ink therethrough by capillary action, and a cylindrical sheath surrounding said core member with spaces therebetween forming a plurality of longitudinally extending outer capillary passages between the inner periphery of the sheath and the outer periphery of the core member, said core member having a tapered forward tip portion extending beyond said sheath, said inner capillary ink conduit terminating at the forward end of said tip portion of the core member and said outer capillary ink passages terminating at the base of said tapered tip portion of the core member, said inner capillary ink conduit and said outer capillary ink passages terminating at their rear ends in said ink reservoir, whereby ink contained in said ink reservoir is introduced from said ink reservoir into said inner capillary

ink conduit and said outer capillary ink passages and flows smoothly, continuously and uniformly through said inner capillary ink conduit and said outer capillary the tip of said nib upon consumption of ink from the tip of the nib due to use of said writing instrument.

8. An improved writing instrument according to claim 7, wherein said inner capillary ink conduit has a lateral cross section of a snowflake shape, with each of said leg portions branching into a plurality of diverging branch leg portions each defining a thin space for the smooth flow of ink therethrough by capillary action.

9. An improved writing instrument according to claim 8, wherein said core member of said writing nib is additionally provided with a plurality of longitudinally extending capillary ink conducting grooves formed in the outer peripheral surface of said core member, said grooves being disposed circumferentially between said branch leg portions of said inner capillary ink conduit.