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(54) PEN POINT MADE OF INORGANIC MATERIAL.

(57) A pen point made of an inorganic material, which is free of restrictions on the viscosity of ink and the particle diameter of pigment to be used, excellent in buckling strength, highly resistant to wear and solvent, and capable of mass production at low cost. It has such a structure that a mixture of fine particles of metal or ceramic with a binder is extruded, degreased, and sintered to form a continuous piece having a uniform cross-section and provided with through holes of various profiles along its axis permitting capillary movement of ink and grooves for ink passage with one end thereof forming a part of the surface sharpened at its tip to be used mainly for writing.

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A PEN POINT MADE OF AN INORGANIC MATERIAL

TECHNICAL FIELD

The present invention relates to a pen point made of an inorganic material to be used for writing.

BACKGROUND ART

A porous pen point is exemplarily proposed in the Japanese Patent Laid-open No.112497/1985.

The conventional porous pen points, including the above pen point, are highly resistant to wear and solvent due to the structure thereof such that the continuous air holes among the particles in a metallic cylindrical body is used as an ink passage to supply ink to the pen point.

DISCLOSURE OF THE INVENTION

Concerning ink viscosity, pigments contained in ink and buckling strength, some restrictions are imposed on the conventional ones due to the employment of the continuous air holes as ink passage.

In other words, in case of a higher ink viscosity or a larger size of pigment particle, ink movement cannot be expected unless the diameter of air hole is larger in proportion with the viscosity or the particle size. Furthermore, the filtration of the pigment particles may occur, causing blinding.

On the contrary, an enlarged diameter of air holes inevitably involves the reduction of buckling strength; if there is prepared a pen point provided with a required degree of buckling strength, there are imposed restrictions on ink, including a lower viscosity of ink and a smaller size of the particle diameter of a pigment in ink.

A wide variety of differences are also found among the diameters of individual air holes of the continuous air holes, which is disadvantageous from the point that a uniform supply of ink in each cylindrical body can hardly be expected.

The present invention has been carried out under such circumstances. It is the object of the present invention to completely resolve the contradictory problems regarding the ink viscosity and pigments in ink and the buckling strength thereof, to provide a pen point made of an inorganic material, with excellent buckling strength and high resistance to wear and solvent and capable of mass production at low coat.

For the object, the pen point of an inorganic material in accordance with the present invention is characterized by the structure wherein a mixture of fine particles of metal or ceramic with a binder is extruded, degreased, and sintered to form a continuous piece having a uniform cross-section and provided along its axis with a through ink passage in the form of holes of various profiles and grooves, permitting capillary movement of ink, with one end thereof forming a part of the writing surface sharpened at its tip.

More specifically, there are proposed as ink passage, a mode of holes of various profiles to be formed in the individual ribs each extending from the outer circumferential portion toward the central direction; a mode of grooves to be formed in the individual ribs each extending radially from the center; a mode of holes of various profiles and grooves, to be formed in the sub ribs extending from the individual ribs; and other optional modes.

The metal is preferably corrosion resistant such as stainless steel, which is also effective for rust prevention.

General ceramic materials known may be used as the ceramic. Preferably, the fine particle of metal or ceramic is nearly in spherical form and of a diameter of 0.1 - 10 μm, whereby the closest packing of the fine particle and the fluidity resistance thereof at extrusion are improved, leading to the relative density of 92 to 97%, so that the buckling strength and the frictional coefficient of the surface of a pen point are improved.

The binder for these particles includes known thermoplastic resins such as polypropylene, a blend of polypropylene and polyacetal and the like, and waxes such as paraffin, etc., to be selected appropriately.

The diameter of a pen point ranges from 0.3 to 2.5 mø.

The following effects are obtained;

1. Because the extruded ink passage extends along its axis under the controlling conditions of its form to be through holes of various profiles and grooves, so as to control and regulate the amount of ink by means of the passage of holes of various profiles and grooves, the pen point of itself is not required to be made porous and the relative density of the fine particles of metal or ceramic can be freely increased up to the degree of a desired numerical figure, so that the pen point has excellent entire properties in terms of buckling strength, rigidity and wear resistance.
2. The ink passage in the form of the holes of various profiles and grooves under control contributes to the ink introduction suitable for individual inks with different viscosities.
3. Because the surface of the ink passage of

holes of various profiles and grooves is formed with fine irregular surfaces caused by the fine particles, leading to good leakage resistance and yield of ink, drop or drain bag won't be caused.

4. The pen point has a structure such that it can be produced in large scale and inexpensively.

BRIEF DESCRIPTION OF DRAWINGS

Fig.1 is a side elevation representing an embodiment of the pen point of the present invention; Fig.2 is an enlarged transverse cross section; and Figs. 3 to 6 are enlarged transverse cross sections representing other individual embodiments.

BEST MODE OF CARRYING OUT THE INVENTION

One embodiment of the present invention will be explained in detail with reference to drawings hereinbelow.

In the figures, A is a pen point; the pen point A is made of metal or ceramic, which is extruded, degreased and sintered to be polished into a desirable form as a pen point.

The pen point A has a through ink passage 1, along its axis, permitting capillary movement of ink, and the ink passage 1 forms a part of the writing surface 2 sharpened at its tip. The final end of the pen point A is in the form of a smaller diameter, in order to be easily inserted in an ink absorber 3, and that ink can make capillary movement from the ink absorber 3 through the ink passage 1 to the writing surface 2.

The width of the ink passage 1 is appropriately determined depending on the viscosity of ink, etc., which is about 0.01 to 0.10 mm.

Specific examples are now illustrated.

In the cross-sectional view of the pen point A illustrated in Fig. 2, long, medium and short-sized ribs 5 each extend from the inner face of the outer circumferential portion 4 toward the central direction, respectively making an equal angle with each other, and the ink passage 1 is in the center and in the form of mutually connecting holes of various profiles.

In the cross-sectional view of the pen point A illustrated in Fig. 3, each of the ribs 5 of an identical length extends from the outer circumferential portion 4 toward the central direction, respectively making an equal angle with each other, and the ink passage 1 is in the center and in the form of mutually connecting holes of various profiles.

In the cross-sectional view of the pen point A illustrated in Fig. 4, long and short-sized ribs 5 each extend from the inner face of the outer circumferential portion toward the central direction, respectively making an equal angle with each other, and the ink passage 1 is in the center and in the form of mutually connecting holes of various profiles.

In the cross-sectional view of the pen point A illustrated in Fig.5, ribs 5 extend radially from the center and respectively making an equal angle with each other, involving the subribs 6 concentrically elongated from each rib 5, whereby the ink passage 1 is largely divided in each rib 5 and is in the form of groove communicating mutually in the subribs 6, within the divisions of holes of various profiles.

In the cross-sectional view of the pen point A illustrated in Fig. 6, ribs 5 extend radially from the center and respectively making an equal angle with each other, where the ink passage 1 is in the form of groove formed nearly radially between adjacent individual ribs 5.

The cross-sectional structure of the pen point A is not limited to the examples illustrated, and the pen point A may be formed into a preferable form including the form of the writing surface 2, on taking into account of ink viscosity, writing angle, orientation and the like.

An example of producing a pen point A in accordance with the present invention is described in the embodiment made of metal illustrated in Fig. 2. A kneading mixture of nickel-made fine particle of a particle diameter of 1 to 5 mø and paraffin having the melting point of about 56 °C is placed in a hopper of an extruder, which is then extruded in a desired cross-sectional form of the cylindrical body and is stretched down to an appropriate diameter. Subsequently the body is cut off in an appropriate length after cooling and solidification.

Then, the cylindrical body is put into a pressure chamber. The pressure chamber is filled with an inert gas of an absolute pressure of about 70 kg f/cm^2 at a temperature of about 230 °C, while the temperature inside is relatively linearly heated from ambient temperature up to about 230 °C and kept at the temperature about two hours. The cylindrical body is then transferred from the pressure chamber to a cooling room and is gradually cooled in the cooling room maintained at about 20 °C, the condensed product being collected. The removing of the binder is continued until the increase in the amount of the condensed product reaches zero.

Subsequently, the cylindrical body is transferred into a sintering furnace and the temperature inside the furnace is heated from ambient temperature to 1260 °C over six hours, in a relatively linear manner. After the body is left in the furnace at the same temperature and under the atmosphere of the inert gas for about two hours, the temperature is gradually lowered. After sintering by such manner, the body was polished to be finally made into

a pen-point form of a diameter of 2.0 mmØ.

The pen point A made of ceramic may be also produced, basically following the same procedure as in the aforementioned producing example, wherein the particle diameter of ceramic fine particle is 1 to 5 μmØ; the main binder is polypropylene; the temperature and time period for removing off binder is normal temperature to 250 °C for 10 hours; and that of the sintering is normal temperature to 1160 °C for 8 hours.

Claims

1. A pen point made of an inorganic material having a structure such that a mixture of fine particles of metal or ceramic with a binder is extruded, degreased, and sintered to form a continuous piece having a uniform cross-section and provided, along its axis, with a through ink passage in the form of holes of various profiles and grooves permitting capillary movement of ink with one end thereof forming a part of the writing surface sharpened at its tip.

2. The pen point made of an inorganic material according to Claim 1, wherein the fine particle of metal or ceramic is nearly in spherical form and of a diameter of 0.1 - 10 μm.

FIG. 1

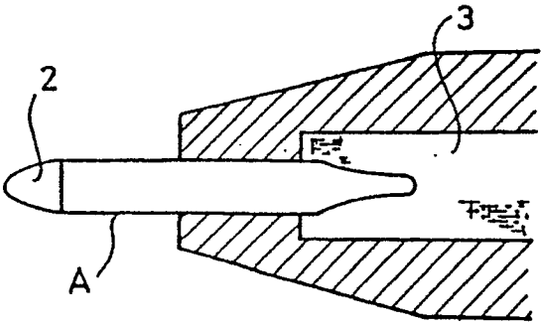


FIG. 2

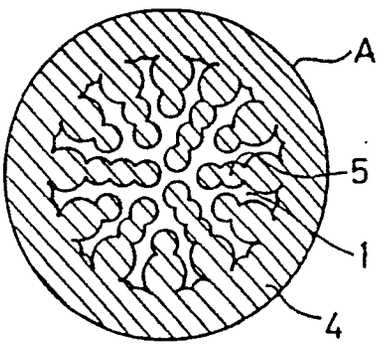


FIG. 3

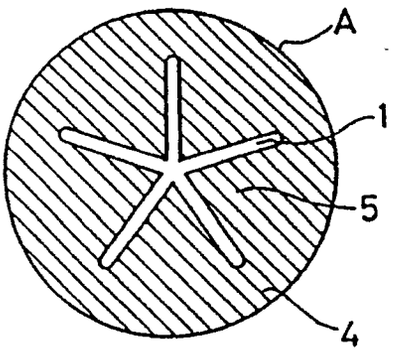


FIG. 4

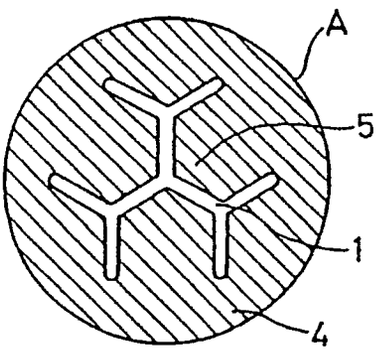


FIG. 5

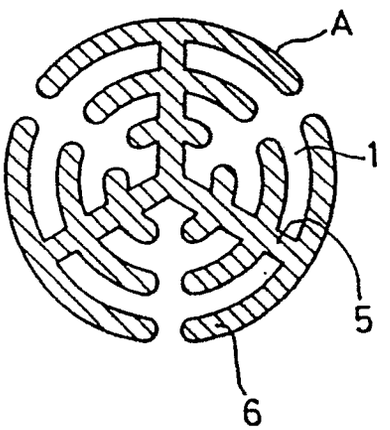
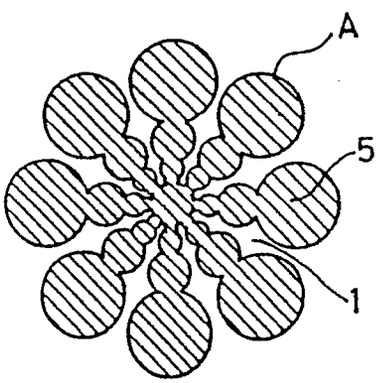


FIG. 6



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/00746

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[5] B43K1/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	B43K1/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho	1967 - 1989
Kokai Jitsuyo Shinan Koho	1971 - 1989

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	JP, A, 59-136294 (Pentel K.K.), 4 August 1984 (04. 08. 84), Full descriptions(Family: none)	1, 2
Y	JP, A, 58-38112 (Pentel K.K.), 3 May 1983 (03. 05. 83), Full descriptions, Figs. 1 to 6 (Family: none)	1, 2

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
August 9, 1990 (09. 08. 90)	August 20, 1990 (20. 08. 90)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	