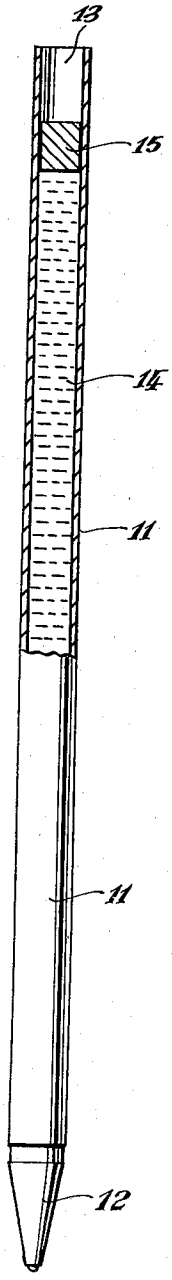
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WRITING INSTRUMENTS

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WRITING INSTRUMENTS

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This invention relates to writing instruments of the ball-point type in which a viscous ink is contained in a reservoir in contact at one end with the ball point itself, and is open at the other end to the atmosphere.

It is important in this type of pen that the ink shall form a continuous column from the reservoir to the ball and that no interruption shall occur due to the presence of air bubbles or the like which would affect the writing.

In order to prevent air from finding its way to the ink at the open end, to prevent leakage and also to prevent deterioration of the ink owing to atmospheric influence, plugs of various types, solid and otherwise, have been disposed in the reservoir in the hope that these will effect the desired sealing and at the same time follow the ink column along the reservoir as the ink is gradually used. It is found, however, that such plugs frequently fail to achieve their purpose under varying conditions of temperature and usage.

When a non-solid plug is employed it must be of a viscous nature, and in the past such a plug has been made of a material which is substantially non-miscible with the ink, so that there is substantially no diffusion of the plug into the ink or of the ink into the plug.

One of the problems involved in the use of a plug is that when the pen is inverted with the ball uppermost and is subjected to knocks, the plug may become detached or jarred away from the ink column. This can be obviated to some extent by making the plug very viscous, but this solution of the problem has the attendant disadvantage that, in use, the very viscous plug may impose an undue resistance to the movement of the ink column thus causing intermittent flow of ink to the ball.

The object of the present invention is to provide improvements in ball-point writing instruments of the kind referred to.

A ball-point writing instrument according to this invention comprises a reservoir containing a column of viscous ink and having a ball-point writing unit at one end with the other end open to the atmosphere, the column of ink being in contact with the ball-point writing unit at that end of the reservoir, whilst a plug is disposed within the reservoir between the open end thereof and the adjacent end of the ink column, and is characterised in that the said plug has a controlled degree of miscibility with the ink. Miscibility means capability of being mixed to form a homogeneous substance having uniform composition throughout.

The plug may comprise bentone grease and a substance similar to a solvent which is contained in the said ink. Bentone grease consists of bentonite and a liquid which is insoluble in said substance.

The percentage by volume of the said substance in the plug is not more than the percentage by volume of the said solvent in the ink.

The effect of this is that there is a controlled amount of mixing of the ink and plug at the boundary between the ink and the plug and this has the effect of "keying"

the ink column and the plug so that there is a greater tendency for both to move together. By the use of this invention it is possible, if desired, to use a plug of less viscosity than those usually in use today, thus lessening the risk of intermittent flow referred to hereinbefore.

In adition to the feature already referred to that the plug has a controlled degree of miscibility with the ink and which is an essential feature of the present invention, there are a number of further desiderata for optium efficiency. Thus we consider that the plug should have the following characteristics:

(*a*) It should be non-volatile.

(*b*) It should be non-hygroscopic.

(*c*) It should have a flat viscosity curve that is affected as little as possible by range of temperature, say between 32° F. and 120° F.

(*d*) The density should be as nearly as possible equal to that of the ink.

(*e*) The viscosity should be not greater than the viscosity of the ink so as not to impose any undue resistance to the movement of the ink column.

In order to provide the desired degree of miscibility with the ink the actual composition of the plug must be related to the nature of the ink used.

If the ink composition includes one of the glycols, then the miscibility of the plug can be obtained and controled by including an appropriate percentage of glycol in the composition of the plug.

Where an ink contains, say, 40% of one of the glycols in its composition, the plug should contain not less than 5% and not more than 20% of a similar glycol, to achieve the desired effect. For example, with an ink containing 38% of a glycol the plug will comprise 93% bentone grease and 7% hexylene glycol. This mixture will bond with the ink in such a way as to obviate any possibility of the plug becoming detached from the ink column. Its viscosity is such that it imposes virtually no frictional resistance to the movement of the ink column to which it is attached, and there is no appreciable deterioration or dissolution of the plug by the action of the solvents contained in the ink thereon, even after a prolonged period.

The viscosity of this plug mixture is substantially unchanged throughout the prescribed temperature range of 32° F. to 120° F.

All of the percentages indicated in this specification are by volume.

In what are known as the oil-based types of ink containing oil-soluble dyestuffs, an oil such as castor, oleic or ricinoleic acid, and a thickener such as colophony, the additive to the bentone grease will be the oil used in the manufacture of the said ink. For example, with an oil-based ink containing 40% of castor oil, the plug will comprise 75% bentone grease and 25% blown castor oil No. 3. The percentage of blown castor oil contained in the mixture must necessarily be varied according to the constitution of the ink and in practice we have discovered that such percentage lies between the limits of 20% and 60%.

In the case of the drying type of inks which are based on dyestuffs, synthetic or naturally occurring resins and little or no oils, the additive to the bentone grease consists of a percentage of the solvents used in the manufacture of the ink. For example, if the solvent in the ink is 25% benzyl alcohol a satisfactory plug material comprises 96½% bentone grease and 3½% benzyl alcohol. The percentage of benzyl alcohol should not be less than 2% nor more than 5%.

Bearing in mind the widely varying nature of the formulae of the inks used in ball-point writing instruments, it is not possible to state the precise proportions of the substance included with the bentone grease in the

plug in order to achieve the desired result, and such factors are best determined by experimentation in each case, but the percentage of the said substance in the plug mixture should not exceed the percentage in which such substance is present as a solvent in the ink and such percentage would in any case lie between the limits of 2% and 60% of the mixture of which the plug is constituted.

A suitable quality of bentone grease for use in the plug is that which is known commercially as "Spheerol B.N.S."

A ball-point writing instrument of the kind to which the invention relates is illustrated in the accompanying drawing which is a longitudinal sectional elevation.

A reservoir **11** has a ball-point writing unit **12** at one end and is open to the atmosphere at the other end **13**. The reservoir **11** contains a viscous ink **14**, and a plug **15** is disposed within the reservoir between the open end 13 and the adjacent end of the column of ink, the plug being in contact with the said end of the ink column.

What I claim and desire to secure by Letters Patent is:

1. A ball-point writing instrument comprising a reservoir containing a column of viscous ink and having a ball-point writing unit at one end with the other end open to the atmosphere, the column of ink being in contact with the ball-point writing unit at that end of the reservoir, and a plug disposed within the reservoir between the open end thereof and the adjacent end of the ink column, said plug comprising a mixture of a substance which is immiscible with the ink and a substance which is miscible with the ink to provide a controlled degree of miscibility of the plug with the ink.

2. A ball-point writing instrument according to claim 1 wherein the plug comprises a mixture of a substance similar to a solvent which is contained in the ink and a bentone grease consisting of bentonite and a liquid which is insoluble in the said substance.

3. A ball-point writing instrument, according to claim 2, wherein the percentage by volume of the said substance in the plug is not more than the percentage by volume of the said solvent in the ink.

4. A ball-point writing instrument, according to claim 2, wherein, when the ink contains approximately 40% of a glycol, the plug comprises between 5% and 20% of a similar glycol.

5. A ball-point writing instrument, according to claim 4, wherein, when the ink contains 38% of a glycol, the plug comprises 93% bentone grease and 7% hexylene glycol.

6. A ball-point writing instrument, according to claim 2, wherein, when the ink contains castor oil, the plug comprises between 20% and 60% castor oil.

7. A ball-point writing instrument, according to claim 6, wherein, when the ink contains 40% castor oil, the plug comprises 75% bentone grease and 25% blown castor oil.

8. A ball-point writing instrument, according to claim 2, wherein, when the ink contains benzyl alcohol, the plug comprises between 2% and 5% benzyl alcohol.

9. A ball-point writing instrument, according to claim 8, wherein, when the ink contains 25% benzyl alcohol, the plug comprises 96½% bentone grease and 3½% benzyl alcohol.

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