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WRITING INSTRUMENT AND INK THEREFOR

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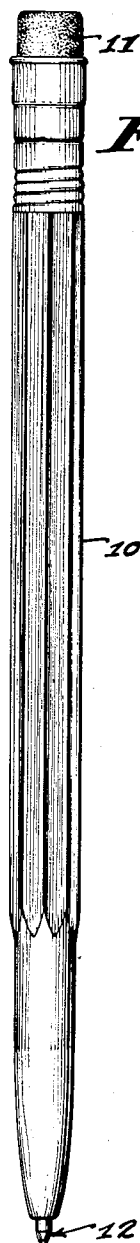


Fig. 1

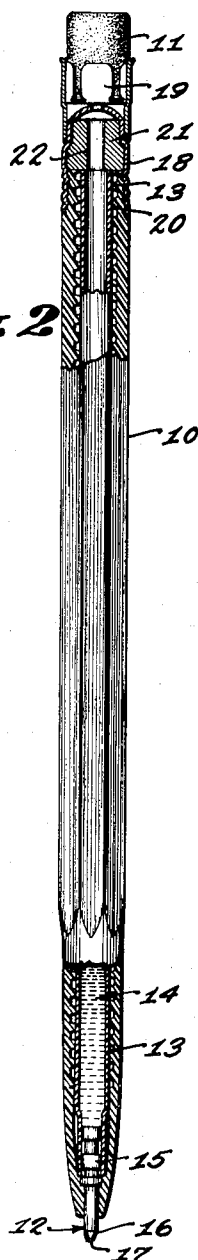


Fig. 2

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WRITING INSTRUMENT AND INK THEREFOR

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2 Claims. (Cl. 120—42.4)

This invention relates to writing instruments, and more particularly to improvements upon the writing instrument disclosed and claimed in Cofield and Seech patent application Serial No. 504,848, filed April 29, 1955, now Patent No. 2,715,388, and an improved ink for use in said writing instrument.

The writing instrument disclosed in said Patent Number 2,715,388, is described therein as a pencil, having an erasable liquid lead, and a permanently sharp point. This writing instrument writes like a wood case lead pencil and the writing on paper therewith is erasable with the usual type of rubber eraser, yet the point of the instrument never requires sharpening and the ease and uniformity of writing on paper is comparable to that of ball point pens because the liquid lead used in this instrument flows from the ball point of the writing instrument with substantially the same ease and uniformity as the flow of conventional ink from the ball of a ball point pen.

Another desirable feature of this type of writing instrument is that the marks or writings produced on paper with this instrument are smear and smudge proof as distinct from writings produced with conventional inks, and also to some extent with the usual lead pencil.

The liquid lead type of ink disclosed in said Patent Number 2,715,388, is in the form of a suspension or dispersion which consists of a viscous liquid vehicle, particularly a viscous resinous material, and carbon, such as, for example, carbon black, lamp black, or graphite in minute size particle form dispersed in the viscous liquid vehicle. This dispersion of the solid carbon particles in the viscous vehicle produces a non-Newtonian body usually of a type rheologically characterized as plastic. In other words, the suspension as a whole is non-Newtonian and has a yield value although the vehicle component of this suspension, when separated from the carbon pigment particles, retains its Newtonian characteristics.

Thus, it is seen that in the liquid lead inks of the type disclosed in the aforesaid patent application, the liquid vehicle, per se, is Newtonian in character although the suspension which is made up of the viscous liquid vehicle and the carbon particles is non-Newtonian, and when the two components become separated the liquid vehicle even though viscous has flow characteristics typical of solutions or Newtonian materials. This fact causes certain objections in the writing instrument using the liquid lead ink under certain adverse circumstances. Examples of the latter are when the writing instrument remains point down for a considerable length of time or the ball point remains in contact with packing or other absorbent materials which exert some wick action on the ink. Under these particular conditions the liquid lead ink of the type disclosed in the aforesaid application tends to break down or separate into its two component parts, of carbon pigment particles and liquid vehicle, and when this occurs the liquid vehicle will ooze or bleed through the narrow clearances between the ball point and ball socket in the

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writing instrument and result in leakage of the liquid at the ball point. Also, when this happens, the other component, namely, the carbon pigment particles, agglomerate and form a press cake back of the ball point which prevents desired operation of the writing instrument.

It will be understood from the foregoing description that the leaking of the liquid vehicle component from the ball point and the packing of the carbon particles above the ball point do not occur in the usual or normal use of the writing instrument but only under certain adverse conditions or circumstances and that the separation of the two components of the liquid lead suspension causes the liquid vehicle to exhibit its normal functional properties as a Newtonian liquid with definite flow characteristics. It would be desirable to avoid this separation of the components under any and all conditions.

An important feature of the present invention is the production of an improved form of liquid lead for use in the above described writing instrument and which liquid lead has the property of remaining as a stable suspension of carbon particles in a liquid viscous vehicle under all conditions. This improvement, which characterizes the present invention, is obtained by using as the vehicle component of the liquid lead composition a viscous liquid which is non-Newtonian, per se, even without the addition of the carbon particles. This non-Newtonian type of vehicle is rheologically a plastic body and has a sufficient yield value to resist the force of gravity or the capillary attraction of absorbent or wick type of material while the writing instrument is in a static condition. However, during writing, the shear exerted by the rotating ball at the pen point reduces the apparent viscosity of the vehicle and also of the suspension to a usable value. That is, the rotating ball would affect the rheological properties of both the non-Newtonian liquid vehicle and the suspension composed of this type of vehicle with the carbon particles. This important property of the non-Newtonian liquid vehicle and the liquid lead writing ink formed from a suspension of this non-Newtonian vehicle with carbon particles will be of particular usefulness in a writing instrument operating under gaseous pressure such as disclosed in Cofield patent application Serial No. 499,076, filed April 4, 1955.

Although suitable types of writing inks having a non-Newtonian liquid vehicle and carbon particles suspended therein have not yet heretofore been commercially produced, surface coating materials, e. g., paints, having non-Newtonian or thixotropic vehicles are disclosed in W. B. Winkler Patent 2,663,649, issued December 22, 1953. Although the thixotropic vehicle principle disclosed in that patent is applicable to the present invention, the compositions disclosed therein are manifestly not suitable in view of the basic distinctions between paints and writing inks and also in view of the drying and hardening properties of the compositions disclosed in that patent which would render them unsuited as such for use as writing inks in ball point writing instruments. Nevertheless the resinous viscous thixotropic liquid vehicles disclosed in that patent are illustrative of the type of vehicle which might be used, with necessary modifications, to form a suspension with the carbon black particles for producing a liquid lead writing ink in accordance with the present invention. Examples I and IX in that patent indicate generally the type of thixotropic vehicle and process of production for possible use in the ink composition of the present invention when properly combined with the carbon particles.

In using the non-Newtonian thixotropic type of liquid vehicle in accordance with the present invention the same general procedure disclosed in the aforesaid Cofield and Seech Patent Number 2,715,388 may be used and generally the same types, forms and grades of carbon disclosed

in that application may also be used in accordance with the present invention as the pigment component of the liquid lead composition. The suspension or dispersion of the minute carbon particles in the non-Newtonian thixotropic liquid vehicle will produce the aforesaid type of liquid lead writing ink having non-smudge, erasable properties, and which ink is not subject to oozing or leaking of the liquid component around the ball point when the writing instrument is point down for a long period of time or is placed in contact with an absorbent material.

This improved writing ink will possess the flocculation properties under static conditions and deflocculation properties under dynamic conditions, disclosed in the aforesaid patent application. In essence, the carbon particles under static conditions, that is, when the writing instrument is not being used, will flocculate sufficiently to prevent the flocculated carbon particles from passing through the small clearances between the ball point and ball socket of the writing instrument. Under the shearing action of the rotating ball during writing the flocculated particles will become deflocculated and thereby sufficiently diminished in size to pass between the ball and ball socket and deposit on the paper, along with the thixotropic vehicle component. This improved liquid lead composition also has the further property disclosed in the aforesaid patent application of again reflocculating when it has been deposited on the writing paper or other surface as a result of the writing operation, and because of this reflocculation function will cause the carbon particles to deposit more on the surface of the paper with very limited penetration thereof into the paper. This deposit of the carbon particles on the surface of the paper renders the writing on the paper erasable.

An illustrative but non-limiting example of the improved liquid lead writing ink of this invention is as follows:

Preparation of vehicle

Resin 847-94A.—The following materials were heated with stirring in a 4000 ml. resin flask equipped with a 12-in. air condenser.

1037 gm. (7.0 moles; 14.0 equivalents) phthalic anhydride
1977 gm. (7.0 moles; 7.0 equivalents) oleic acid
680 gm. (7.4 moles; 22.2 equivalents) glycerol

Carbon dioxide was bubbled through the mixture during the reaction. The temperature was maintained at 170–220° C. until the acid number was 8. The product had a viscosity of Gardner Z7.

Resin 847-94B.—To 1035 gm. of Resin 847-94A was added 51.8 gm. General Mills polyamide 95; the mixture was heated for 0.5 hr. at 225–235° C.

Vehicle.—The ink vehicle was prepared by adding 197.5 gm. Resin 847-94A to 52.5 gm. Resin 847-94B and stirring until the two ingredients were thoroughly mixed.

Preparation of ink

To fifteen (15) parts of the vehicle prepared as described above, was added two (2) parts Molacco Black (Binny and Smith Co., New York, N. Y.) The resulting mixture was well stirred and then heated in a water bath over night at 170° F. This mixture was then cooled and milled twice using a 3-roll steel mill. The ink so produced had a plastic viscosity of 15800 cps. (Brookfield viscometer, Model RVF, Spindle No. 7 at 15 R. P. M.) at 80° F.

The liquid lead used in the writing instrument of this invention may contain graphite or carbon black of a suitable type, such as lamp black, furnace black, channel black, or thermal black. In the usual case, we have found certain furnace blacks; e. g., Molacco Black, to be advantageous from the standpoint of particle size and uniformity of dispersion in the liquid vehicle.

The proportions of the carbon and vehicle will vary somewhat with the different specific forms of each, but

generally will be of the order of 2 to 14 parts of the carbon to 100 parts of the vehicle. The minimum amount will depend upon the desired blackness or darkness of the writing. Also the proportion of the carbon to the vehicle will vary with and depend upon the type of carbon used. The following are illustrative examples of the proportions of different carbon materials based, in each case, upon the use of 100 parts of vehicle:

	Parts
10 Lamp black	7 to 14
Furnace black	7 to 10
Thermal black	7 to 10
Channel black	2 to 5
Graphite	5 to 14

Similarly, the size of the individual carbon particles (unflocculated) will vary with the different carbon materials, as follows:

	Microns
20 Lamp black	0.01 to 0.4
Furnace black	0.045 to 0.075
Thermal black	0.045 to 0.075
Channel black	0.010 to 0.035
Graphite	3 or less

A writing instrument for utilizing the improved liquid lead composition such as described above is illustrated in a non-limiting form in the accompanying drawing in which:

Fig. 1 is an elevational view of the writing instrument; and,

Fig. 2 is a corresponding view partly in section.

Referring to these two figures of the drawing, the writing instrument as shown comprises a barrel 10, a rubber eraser 11, and a ball point 12. Contained within the barrel 10 is a reservoir tube 13, which holds a supply of the liquid lead 14. The reservoir tube 13 may be made of metal, resin, plastic or any other suitable material. Into one end of this reservoir tube is fitted a ball point insert 15, which terminates in a ball point socket 16 containing a writing ball 17.

At the rear end of the barrel 10 a metal ferrule 18 is arranged as a cap on which a sleeve 20 is fitted to receive the eraser 11 and bore cover 19 therefor, and in which a suitable plug 21 is disposed for abutment with the top end of the reservoir tube 13. The plug 21 has an aperture 22 extending therethrough to permit venting of the ink tube 13 to the atmosphere.

Various modifications and changes may be made in the above described writing instrument and materials thereof as indicated in the scope of the appended claims.

This application is a continuation-in-part of application Serial Number 527,987, filed August 12, 1955, now abandoned.

I claim:

1. A writing instrument comprising a barrel, a reservoir within the barrel, a supply of liquid lead within the reservoir and a ball point connected to the liquid lead supply and located in writing position at one end of the barrel, said liquid lead comprising a dispersion of carbon particles in a non-Newtonian, thixotropic liquid vehicle and said dispersion being in flocculated form so as not to pass said ball point when the writing instrument is not in use, and being subject to break-down by the action of the ball point during writing and said vehicle being subject to reduction in apparent viscosity by the action of the ball point, for feeding thereby.

2. A writing instrument comprising a barrel, a supply of liquid lead housed within said barrel, and a ball point supported in writing position at one end of said barrel for feeding said liquid lead supply during writing, said liquid lead supply comprising carbon dispersed in a viscous, non-Newtonian, thixotropic liquid vehicle and flocculated sufficiently to prevent the dispersion from passing said ball point when not in use for writing, said dispersed carbon becoming deflocculated and said vehicle

becoming reduced in apparent viscosity under the shearing action of the ball point as it rotates during writing for feeding said liquid lead supply.

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