Sept. 16, 1958 G. A. GOESSLING 2,852,397

NON-SOLID ERASABLE WRITING MEDIUM AND INSTRUMENT UTILIZING SAME

Filed Dec. 21. 1953

Fig. 1.

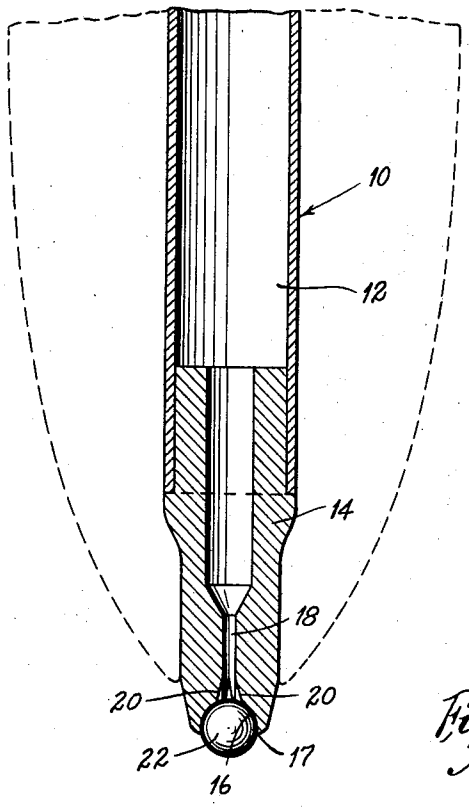


Fig. 2.

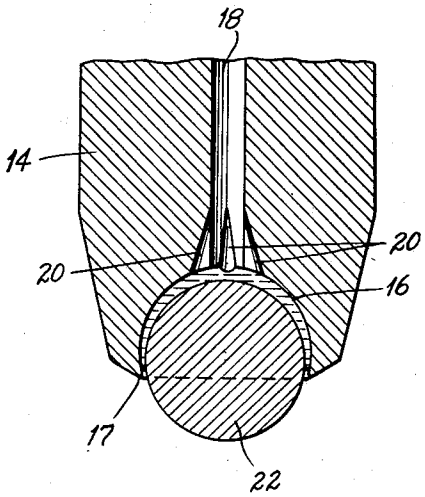
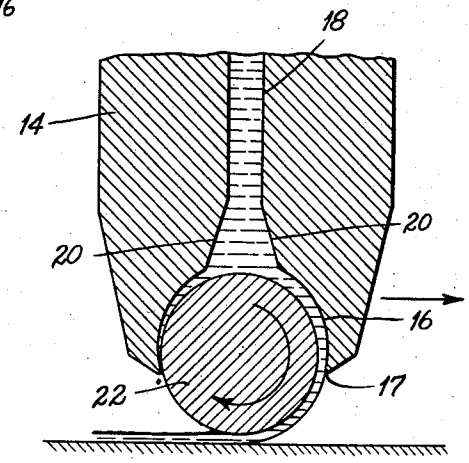


Fig. 3.



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NON-SOLID ERASABLE WRITING MEDIUM AND INSTRUMENT UTILIZING SAME

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The present invention relates generally to writing instruments employing erasable writing media, and more particularly to a non-solid, erasable, writing medium which simulates the markings of conventional pencil "leads," and a mechanical construction for utilizing it.

It is well-known that for many years, first in Europe and then in the United States, rotating-ball type writing instruments have been used which employ ink in the form of a true solution, i. e., a dye substantially or completely dissolved in a carrier and which penetrates into the fibers of the writing paper so as to be difficult to erase.

It is equally well-known that for almost as many years, many inventors have been seeking a non-solid, erasable, writing medium which simulates the markings of conventional pencil "leads" and which can be used in a rotating-ball type writing instrument—but without success.

Until the advent of the present invention, all known lead pencil like writing instruments employing fluid or paste like composition were very unstable in that they were difficult to restart after they had been unused for a few hours or a few days. Some clogged and starved, i. e., the flow of the writing medium would stop while they were being used. In others, the writing medium came out in "globs" so that the written line had a lumpy appearance.

It is an object of the present invention, therefore, to provide a novel, non-solid, erasable, writing medium which simulates the markings of conventional pencil "leads," and a mechanical construction for applying the writing medium to paper and like material. More particularly, it is an object to provide a non-solid writing medium and a mechanical construction for applying it to paper and the like in a thin film or layer, and which has substantially the same appearance as marks made by conventional pencil "leads" and can be erased in like manner. Specifically, it is an object to provide a non-solid writing medium which can be varied within controlled limits so as to simulate the marks made by practically all grades of conventional pencil "leads," from a very soft "lead" to the relatively hard "leads" used in drawing pencils, and which, when applied to paper and the like in a thin film, provides a deposit of solid particles on the surface thereof similar to the deposits made by frictionally removing particles from conventional pencil leads as by moving them over the surface of paper, and which can be readily erased in like manner.

Another object of the present invention is to provide a mechanical writing construction and a non-solid erasable writing medium which does not leak therefrom, which remains stable over long periods of time, and which does not leave globs or dots, or broken, unmarked spaces when moved over the paper. More particularly, it is an object to provide such a combination whereby the medium does not leak from the unit regardless of the position in which it is held, but flows from the instrument the instant the latter is moved over the paper or the like, even after long periods of nonuse, so as to deposit a uniform, uninterrupted line or film on the surface thereof.

Yet another object of the present invention is to provide a novel writing instrument employing a non-solid writing medium which can remain uncapped in the same manner as conventional "lead" pencils. More particularly, it is an object to provide such combination in which the surface around the point of the writing instrument remains clean even after long periods of use, and in which the writing medium remains within the instrument until the latter is moved over the paper or the like, and which does not leak or "bleed."

Further objects and advantages of the present invention will be readily apparent from the following detailed description.

Broadly speaking, the invention includes a writing medium comprising a colloidal dispersion of pigment particles in a lubricated or oily carrier having predetermined viscosity, adhesive, and cohesive characteristics, in combination with a rotating-ball type instrument for applying the medium to paper and the like in a thin film, and which has the space between the ball and its seat and the size and number of feed grooves so constructed in relation to the viscosity of the writing medium and the size of the graphite particles as to feed the writing medium continuously and uniformly onto the paper and the like.

In the drawing:

Fig. 1 is an enlarged, fragmentary, vertical, sectional view of the lower end of a unfilled reservoir and writing tip unit embodying the teachings of the present invention, the body of the writing instrument being shown in broken lines inasmuch as it forms no part of the invention;

Fig. 2 is a further enlarged, fragmentary, vertical, sectional view of the lowermost end of the unit, the space between the ball and its seat being exaggerated to illustrate the location of the writing medium when the unit is not used, the writing medium being shown only around the ball itself so as not to interfere with the disclosure of the feed grooves; and

Fig. 3 is a view similar to Fig. 2 but schematically illustrating the flow of the writing medium from the unit as the ball is moved over the surface of writing paper or the like. In actual operation, the ball produces a groove or indentation in the paper but this is not indicated in the drawing for obvious reasons.

Referring to the drawing more particularly by reference numerals, specifically Fig. 1, **10** indicates generally a writing unit constructed in accordance with the teachings of the present invention, and which includes a capillary tube **12** which has a machined fitting **14** fastened to the lower end thereof.

The fitting **14** contains a ball seat **16** at the lower end and includes a lower peripheral edge **17**, the ball seat being in communication with the interior of the capillary tube **10** through a capillary passageway **18**.

At the lower end of the capillary passageway **18** are a plurality of feed grooves **20** which increase the flow of the writing medium from the capillary passageway to the ball seat **16**.

Rotatably mounted in the seat **16** is a ball **22** of polished stainless steel or sapphire.

I have found that in order for a colloidal dispersion of solid pigment particles to operate satisfactorily in a rotating-ball type writing instrument, it is necessary for it to have certain general physical characteristics which can best be described as viscid or tacky, and I have also determined the type and amounts of materials which will produced the desired characteristics, as well as some measure of the various characteristics required.

The writing medium must have sufficient "body" and cohesive strength to remain within the writing unit and to produce marks which simulate the marks produced by conventional pencil "leads." On the other hand, it cannot be too viscous or it will not flow freely through the writing instrument. Also, it should not penetrate too

quickly into the fibers of the paper, otherwise it will carry the particles too deeply into the paper and make the erasure thereof more difficult.

It must have sufficient cohesive strength with respect to itself (surface tension), whereby it will not crawl, slip or leak from around the ball or from the upper end of the writing unit, but will work down toward the ball as the writing medium is consumed. The cohesive or film strength must also be sufficient to cause the medium to flow or be pulled in a uniform, unbroken film, from the capillary tube, around the ball, and onto the writing paper.

The medium must also have sufficient adhesive strength or affinity for the ball to cling to it and be pulled from between the ball and its seat, and onto the paper. However, its affinity for the writing paper must be much greater than its affinity for the ball so that it will be transferred from the ball onto the paper and will not pile up on the peripheral edge 17. Referring to Fig. 3, it will be noted that as the unit is moved from left to right, the film flows (or is pulled) in a clockwise direction around the ball, and, if the affinity of the medium for the ball were too great, i. e., greater than its cohesive strength or its affinity for the paper, it would be carried around by the ball and pile up on the peripheral edge 17 on the left instead of transferring to the paper or withdrawing into the space between the ball and its seat, thereby resulting in a dirty or messy point. Furthermore, when the writing unit is removed from contact with the paper, some of the medium may remain on the exposed surface of the ball so that it is desirable for the medium to have more cohesive strength with respect to itself than adhesive strength with respect to the surface of the ball whereby it will contract or draw back into the space between the ball and its seat, and provide a clean point.

The preferred black writing medium comprises a colloidal dispersion of graphite particles in a lubricated or oily carrier, in which substantially all of the graphite particles are less than 7 microns in size, and preferably no more than about 3 to 4 microns. A mixture of carbon and graphite particles can be used, but graphite particles alone produce better results because they more closely simulate the marks made by conventional pencil "leads," and, being of a lubricating nature, they flow more freely. If very many particles of a larger size than 7 microns are used, there is a tendency for the writing instrument to clog or jam due apparently to a bridging or piling up of the particles in the feed grooves or between the ball and its seat.

As to the amount of graphite particles which should be used, best results are obtained when the particle content of the dispersion is between about 10% to 25%, by weight, and preferably between about 15% to 17%. Under 10% the marks which are produced are lighter than those produced by conventional pencil "leads," and above 25% it is difficult to produce a satisfactory, free-flowing medium. As previously mentioned, the solid particle content is varied in order to produce writing media which simulate the marks made by conventional hard, medium or soft pencil "leads."

When the solids content is increased, it is necessary to increase the lubrication qualities and to decrease the viscosity of the carrier. However, if the viscosity of the carrier is reduced too low there is a noticeable increase in frictional drag on the ball and the unit will not write satisfactorily on slippery or wet paper.

The viscosity of the carrier also affects the erasability of the writing medium. The carrier should deposit the particles on the surface of the paper in a thin film and then slowly penetrate into the paper leaving the particles on the surface. This produces marks which closely simulate the marks produced by conventional pencil "leads," and which are readily erased. With a carrier of low viscosity, the particles are carried further into the fibers of the paper, and the marks are more difficult to erase. From the standpoint of erasability it would be desirable to have a very viscous carrier, but, if the writing medium is too viscous it is not sufficiently free-flowing and there is a tendency for the unit to starve or skip.

As previously mentioned, in order for a colloidal dispersion of pigment particles to operate satisfactorily in a rotating-ball type writing instrument, it is necessary for the resultant medium to be sort of sticky or tacky and to have relatively high cohesive and adhesive strength, with the cohesive strength being greater than the adhesive strength with respect to the ball or the inner surface of the capillary tube. This result can best be achieved by using a lubricated carrier which has a relatively high initial stickiness or tackiness, or by adding a substance or substances to a carrier in order to increase these characteristics. In short, it is necessary to have a resultant medium with relatively high lubricating qualities and good cohesive and adhesive characteristics, as previously described.

I prefer to start with a colloidal dispersion in a light oil (15 SAE) having a paraffin base, because of its improved lubricating characteristics, but most oils and the like having good initial lubricating characteristics are satisfactory. To obtain the maximum concentration of graphite in the preferred final weight range (15% to 17%) above pointed out, a dispersion of about 30% by weight of graphite in oil has been used.

When an oily carrier is used, a highly successful additive for increasing the tackiness or cohesive strength of the colloidal dispersion is a tarry petroleum or bituminous material such as asphalt or tar, dissolved in oil or a petroleum thinner, or any like synthetic or natural substance which is compatible with graphite and oil.

One method of preparing the additive is to dissolve pure asphalt or tar in VMP (varnish makers and printers) naphtha and a light oil having a high heat range, as for example, Socony-Vacuum DTE which is a 15–20 SAE heat resistant oil. After the asphalt or tar is dissolved, the naphtha is driven off by heating the mixture, thereby leaving the asphalt or tar dissolved in the oil.

Best results are obtained when the ratio of the asphalt to oil, by volume, is in the neighborhood of about 4 to 1, i. e., when the asphalt content in the additive is about 80%. The dissolved asphalt comprises about 16% to 32% by volume of the writing composition.

This additive is then mixed with the previously prepared graphite dispersion so that the additive comprises about 20% to 40%, by volume, and the colloidal dispersion comprises about 60% to 80%, producing a resultant writing medium having a surface tension of about 30 to 40 dynes per cm. at 25 degrees C. and a viscosity of between about 5000 to 11,000 centipoises. When 60% of the colloidal dispersion is selected of about 30% concentration as before stated, the maximum preferred amount of graphite particles in the final composition is about 17%. However, one can use less oil with the particles and more oil with the asphalt, or vice versa—the important point is to have the resultant writing medium contain the proper amount of pigment particles and tarry material to achieve the desired result.

Satisfactory results are also obtained by using in place of the aforementioned additive, a light polymerized hydrocarbon such as "Paratac," or Cities Service Cisco No. 5Z. "Paratac" is produced by Enjay Co., Inc., New York City and consists essentially of a high molecular weight (80,000 to 120,000) polyisobutylene in solution in oil. "Cisco No. 5Z" is produced by Cities Service Oil Company of Chicago and consists essentially of a residual distillate (similar to asphaltum) in trichloroethylene and has a viscosity of about 5,000 seconds at 210° F.

The writing medium described above is further improved by adding to it a small amount of a wetting agent such as oleic acid, stearic acid or one of the metallic soaps. About ½% to 1% of oleic acid is very

satisfactory, but like amounts of the other substances may be used.

The addition of a small amount of what is normally considered to be a wetting agent appears to decrease the affinity of the medium for the ball, and, at the same time increases its affinity for the writing paper. Consequently, the writing medium has less tendency to be carried completely around the ball by the rotation thereof and is more easily transferred to the paper, as previously described.

Also, by decreasing its affinity for the ball without appreciably decreasing its cohesive strength, when the writing instrument is removed from contact with the paper, any of the medium remaining on the exposed surface of the ball is caused to be drawn back into the space between the ball and its seat. This produces an extremely clean point whereby the writing instrument can be placed in the user's pocket or purse without requiring a cap or cover over the writing end thereof.

In addition to using a black pigment such as graphite or carbon, I have also successfully used colored pigments such as red, yellow and blue to produce non-solid, erasable, writing media in rotating-ball type writing instruments, which simulate the marks made by conventional colored pencil "leads." The colored pigments which I used are known in the industry as organic "toners" and are essentially organic salts, the red being barium lithol, and the blue being monastral blue. Very satisfactory results have been obtained by using about 12% solid particles in an oily carrier containing a tarry additive of the type previously described.

Thus, it is apparent that there has been provided a novel, non-solid, writing medium which simulates the markings of conventional pencil "leads," both black and colored, and which can be erased in like manner, and a mechanical construction for utilizing it. Also, the solid particle content of the medium can be varied within predetermined limits to produce marks which range all the way from the marks made by very soft pencil "leads" to the marks made by very hard "leads."

The writing medium does not leak from the point or the other end of the writing unit, regardless of the position in which it is maintained. However, the unit is very stable and will write as soon as it is moved over the paper, even after long periods of nonuse, so as to deposit a uniform, uninterrupted line or film on the surface thereof. The carrier is absorbed by the paper, leaving a deposit of solid particles substantially wholly on the surface thereof, which can be removed by erasing in the same manner as marks made by conventional pencil "leads."

Also, the point of the unit remains clean at all times so that it can be placed uncapped in the user's pocket or purse in the same manner as conventional "lead" pencils.

It is to be understood that the foregoing description and examples and the accompanying drawing have been given only by way of illustration and example and that changes and alterations in the present disclosure, which will be readily apparent to one skilled in the art, are contemplated as within the scope of the present invention, which is limited only by the claims which follow.

What is claimed is:

1. A writing composition which simulates the markings of a conventional pencil lead consisting essentially of a stable colloidal dispersion of graphite particles in a light petroleum oil with substantially all of the graphite particles being less than 7 microns in size as the pigment and said graphite particles being from 10% to 25% by weight of the writing composition, a carrier comprising a tar-like substance selected from the group consisting of tar derived from petroleum and bituminous distillate residue and asphalt dissolved in a petroleum thinner and oil, said colloidal dispersion being from 60% to 80% by volume of the writing composition and said carrier being from 20% to 40% by volume of said writing composition and said tar-like substance being from about 16% to 32% by volume of said writing composition.

2. A writing composition as recited in claim 1 in which the light oil of the colloidal dispersion is a light mineral oil and the tar-like substance is asphalt.

3. A writing composition as recited in claim 2 in which the ratio of asphalt to oil is 4 to 1 by volume when the asphalt content in the additive is about 80%.

4. A writing composition as recited in claim 1 for use in a ball type writing implement and to which writing composition is added a small amount of metallic soap selected from a group consisting of oleic acid and stearic acid to increase the affinity of the composition for itself and the paper so that said ball type writing implement is always clean.

5. A writing composition as recited in claim 4 in which oleic acid is added in the amount of about ½% to 1% to increase the affinity of the writing composition for itself and for the paper so that when the writing implement is removed from the paper any of the composition left on the ball will be drawn back into the writing implement thereby maintaining the ball in a clean condition.

6. A writing composition as recited in claim 1 in which the resultant composition has a surface tension of about 30 to 40 dynes per cm. at 25° C. and a viscosity of about 5,000 to 11,000 centipoises.

7. A writing composition as recited in claim 1 in which substantially all of the graphite particles are less than 4 microns in size.

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