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WRITING INSTRUMENT AND PROCESS OF MAKING THE SAME

Filed April 12, 1968

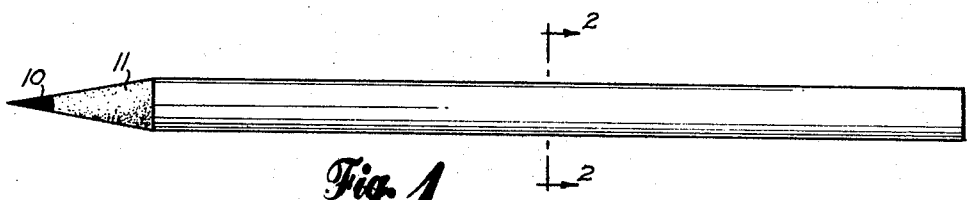


Fig. 1



Fig. 2

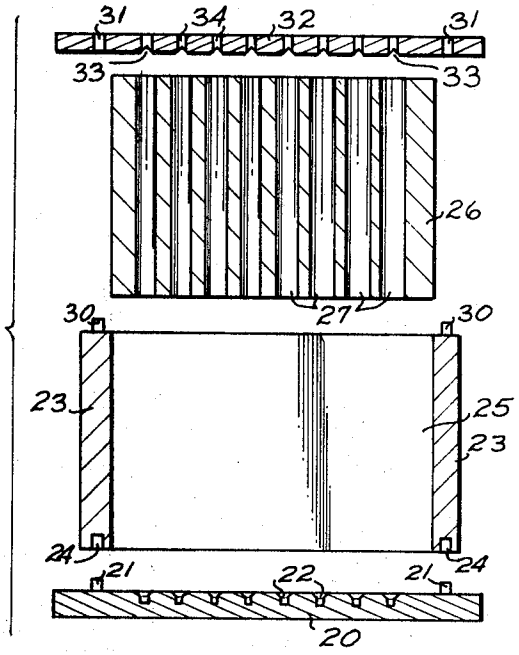


Fig. 3

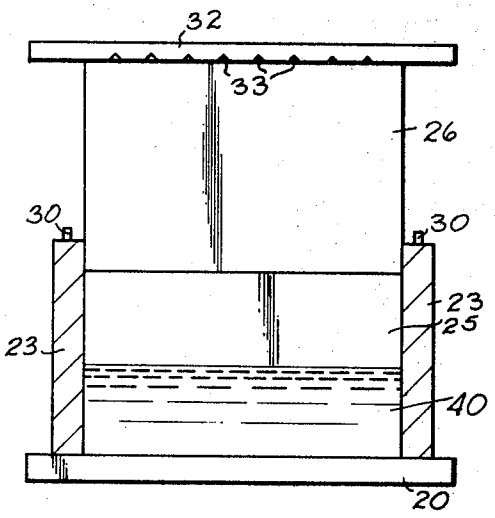


Fig. 4

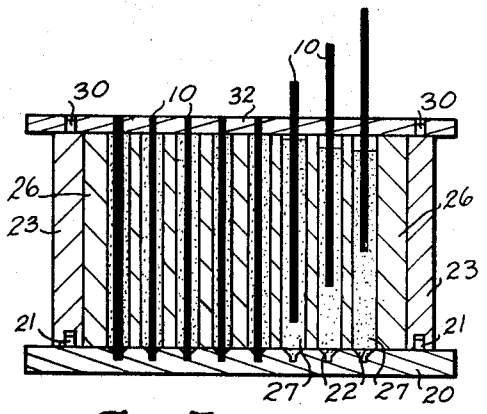


Fig. 5

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WRITING INSTRUMENT AND PROCESS OF MAKING THE SAME

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ABSTRACT OF THE DISCLOSURE

A writing instrument having a conventional cylindrical writing core, such as a rod of graphite, encased in polymerized water-extended polyester. A process of filling cavities with the uncured plastic emulsion from the bottom and inserting the writing core in the emulsion and curing the same.

This invention relates to writing instruments and is more particularly concerned with an instrument having a central writing core which is encased in a water-extended plastic material and to the process of making the same.

In the past, pencils have been manufactured by disposing a plurality of evenly spaced parallel cylindrical rods of graphite between grooves of two relatively flat pieces of cedar which are adhered together. Thereafter, the wood is cut between the graphite cylinders and shaped to the final familiar hexagonal or round shapes. The pencils are then painted and the erasers installed on the ends thereof. It is becoming increasingly difficult and expensive to obtain suitable cedar for the pencils and yet, at the same time, produce pencils which are inexpensive.

The weight of a conventional pencil is quite important since the public has been educated to expect a pencil which is not too heavy and yet not too light. Therefore, it is important that any pencil should be of approximately the same weight as a conventional pencil.

Briefly described, the writing instrument of the present invention includes a cylindrical graphite writing core which is encased in a tubular seamless casing formed from a polymerized water-extended polyester. In the process of manufacturing this pencil, an emulsion is made up of water and the polyester material, to which is added the appropriate curing agents. This emulsion is fed into a casting cavity, from the bottom, so that little or no air is entrained in the emulsion, as the cavity is filled. The "lead," or other writing core material, is then inserted into the emulsion and this combination is permitted to cure at room temperature. Thereafter, the pencil is removed from the cavity and subjected to heat to dry out a prescribed amount of the moisture from the pencil. The resulting pencil is easily sharpened in a conventional sharpener and has the appearance, weight, and feel of a conventional wooden pencil.

Accordingly, it is an object of the present invention to provide a writing instrument which is inexpensive to manufacture, durable in structure, and efficient in use.

Another object of the present invention is to provide a writing instrument in which the weight of the instrument may be adjusted during the process of manufacture.

Another object of the present invention is to provide a writing instrument which is lubricated and cooled as it is sharpened.

Another object of the present invention is to provide a writing instrument which may be readily colored, painted, and may be formed into a plurality of predetermined shapes.

Other objects, features, and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views and wherein:

FIG. 1 is a side elevational view of a writing instrument constructed in accordance with the present invention, the instrument being in a sharpened condition;

FIG. 2 is a cross-sectional view taken substantially alone line 2—2 in FIG. 1;

FIG. 3 is an exploded vertical sectional view of a die employed for producing the writing instrument of FIG. 1;

FIG. 4 is a partially broken away side elevational view of the die of FIG. 3, fitted together and receiving a prescribed amount of the emulsion from which the casings, such as the casing of the writing instrument illustrated in FIG. 1, are formed and showing the die block being inserted into the sleeve of the die; and,

FIG. 5 is a vertical sectional view of the die of FIGS. 3 and 4 fully fitted together and showing the inserting of the writing cores into the casing cavities of the die.

Referring now in detail to the embodiment chosen for the purpose of illustrating the present invention, it being understood that in its broader aspects, the present invention is not limited to the exact details herein depicted, numeral **10** denotes a writing core which, in the present embodiment, is a cylindrical graphite-clay tubular rod, commonly referred to as the "lead." The writing instrument is provided with a plastic casing **11** formed from a polymerized water-extended polyester which encases the core **10**. The casing **11**, as illustrated in the present invention, is seamless and cylindrical in cross-section, as seen in FIG. 2. It will be understood, of course, that the outer surface of the writing instrument may be hexagonal or any other desired shape. The tubular, cylindrical graphite writing core **10** is disposed along the axis of the casing **11**, being concentric therewith.

The material from which the casing **11** is made is a polymerized water-extended polyester which is a hard, fine grained substance consisting of a plastic matrix containing encapsulated microscopic particles of water fixed uniformly and semi-permanently therein. The water droplets, in the closed-cells or spheres of the matrix are between two and five microns in size. In producing the compound for casting the casing **11**, the unsaturated polyester resin is mixed with water to form a milkshake-like emulsion. Thereafter, the catalyst for curing is added, immediately prior to the time that the material is poured into a die.

A mixture, containing fifty percent water and fifty percent polyester resin gives the strongest structure; however, the mixture may go as high as ninety percent water, if desired. The resulting polymerized or cured water-extended polyester resin, containing fifty percent water, gives tensile strength of about 2000 p.s.i., a compressive strength (failure) of about 5000 p.s.i. and a flexural strength of about 36,000 p.s.i. At 50 to 60 percent water in the resin, the resin is about 63 to 66 pounds per cubic foot. With a resin containing 50 to 60 percent water, the water is retained in the plastic matrix almost indefinitely. If about 75 percent water, the material dries out readily because the cell walls are thin and there is a rapid cell-to-cell diffusion of the water.

If desired, pigments of various kinds and both oil and water soluble dyes or pigments may be added to the emulsion so that the resulting casing **11** is practically indistinguishable from wood. Fillers, such as shell flour in an amount up to about 30 percent and preferably from 20 percent to 30 percent by weight can be added to the emulsion, if desired. Also, the exterior of the casing **11** may be painted with conventional paint, if desired.

Preferably, from 40 to 80 percent, by weight, water is mixed with the resin to form the emulsion. The emul-

sion sets up at room temperature. Liquid plastic preparations are water-in-oil emulsions, immiscible in water, which cure rapidly to yield the solid material. In mixing the emulsion, water is added to the resin, not vice-versa.

When it is desired to cure the emulsion, a catalyst is then added so that the resin phase rapidly gels. When the resin is fully cured, for all practical purposes, the water is semipermanently locked in.

While we prefer for the pencils to remain in the mold for at least one-half hour, the pencil may, if desired, be de-molded in ten minutes or less, after the emulsion has jelled.

Increasing the water from 50 percent to 75 percent in the emulsion reduces the physical strength of the resulting casing **11** to one-fourth the values of the 50 percent water casing **11**.

A better understanding of the present invention will be had by reference to the following examples of specific formulations resulting in the pencils illustrated in FIGS. 1 and 2.

EXAMPLE I

The molds used for forming the pencils were random-lengthed pieces of glass tubing (7½ inches to 9½ inches) and approximately 6½ millimeters inside diameter. One end of each tubing was fitted with a nylon plug approximately ⅜ inch in length. This was bored with a .078 inch hole to accommodate a .078 inch pencil "lead." The lead was a conventional graphite-clay rod, common to a wooden pencil. The lead was centered, by eyesight, in the tubes. A water extended polyester emulsion was made by mixing 2000 cc. of liquid unsaturated polyester resin (Ashland Chemical Company's WEP 26) with 25 cc. of 12 percent cobalt octoate and 10 cc. of dimethyl analine. To this solution was slowly added, while stirring, 2000 cc. of tap water. To this stable emulsion was added 10 cc. of 11.5 percent (active oxygen) methyl ethyl ketone peroxide. Each of the glass tubes was immersed, to a depth of approximately one-half inch, in the emulsion and the emulsion drawn, by suction, into the tube to within one inch of the top. The nylon plug with the pencil lead was then inserted into each of the tubes and the resulting assembly set aside to cure at room temperature for approximately 30 to 45 minutes, at which time the polymerization reaction was sufficient to permit removal of the "pencils." Each pencil was then sharpened in a mechanical pencil sharpener of the type found in schools and offices. The resulting pencils were seamless and had the appearance and the feel of a conventional wooden pencil.

EXAMPLE II

The procedure of Example I was followed except that the emulsion was made up having 70 percent water and 30 percent resin, by weight. The resulting pencils appeared to be more flexible than the pencils of Example I. The pencils of Example II weighed approximately 5.540 grams, each.

EXAMPLE III

The pencils of Example II were heated in an oven at 150–160° F. for one hour, immediately after being removed from the mold. The pencils were then reweighed to determine the loss of moisture. The weight of the pencils was approximately 4.681 grams, each, a weight reduction of approximately 15.5 percent.

If the pencils of Examples I and II were permitted to cure for an extended period of time, substantially less weight reduction would have been effected by the subsequent heating of the pencils. Therefore, it is important to heat the pencils immediately after the initial curing if a controlled weight reduction is desired.

The resulting pencils of Examples I, II and III were readily sharpened an readily resharpened. The water encapsulated in the resin served as a lubricant for the sharpening operation and also served to cool the plastic, thereby enabling the sharpener to operate more efficiently.

While many methods may be employed for producing the writing instrument disclosed in FIGS. 1 and 2, it is preferable that a casting operation be employed in which the emulsion for forming casing **11** is filled into a cavity from the bottom upwardly, to prevent the entrainment of air in the emulsion.

The die of FIGS. 3, 4 and 5 is for this purpose and includes a flat square or rectangular base plate **20**, having upstanding alignment pins **21** along its edge portions. The upper surface of base plate **20** is provided with a plurality of transversely and longitudinally aligned downwardly tapered alignment holes **22**, the purpose of which is to center the writing core **10** for each cavity of the die, as will be explained hereinafter.

Above the base **20** a square rectangular tubular member or sleeve **23** is provided, the sleeve **23** having recesses **24** which are brought into registry with the upstanding alignment pins **21**. The exterior of the sleeve **23** has the same contour as the base **20**, while the interior cavity **25** is hollow, being preferably either square or rectangular and open at both ends. When the sleeve **23** is inserted over plate **20** such that the alignment pins **21** are received in the recesses **23**, the bottom edge of the sleeve **23** fits snugly against the upper surface of the base plate **20** to form a cup.

For being slidably inserted from the top into the hollow interior **25** of the sleeve **23**, a die block **26** is provided, the die block **26** having essentially the same contour and dimensions as the inside dimensions of the sleeve **23**. Thus, the die block **26** can be snugly received within the interior **25** of sleeve **23**.

The die block **26** is provided with a plurality of parallel vertical straight hexagonal or round bores or casting cavities **27** arranged in parallel transverse and longitudinal rows throughout the die block **25**. Each of the bores or cavities **26** is open at both ends, extending from the bottom surface of die block **25** to the top surface thereof. These parallel vertical casting cavities **27** are respectively aligned with the alignment holes **22** of base plate **20**. Thus, when the die block **26** is inserted in the sleeve **23**, there is an individual alignment hole **22** aligned with each cavity **27** to form the bottom of that cavity.

The upper edge of sleeve **23** is provided with appropriate upstanding alignment pins **30** which are received in recesses **31** of a flat rectangular or square top plate **32**. The top plate **32** is provided with flat upper and lower surfaces, there being transverse ridges or recesses **33** along the lower surface of the top plate **32** for the purpose of releasing gasses from the die. These grooves **33** are so arranged that each of the casting cavities **27** is open to the atmosphere even though the top plate **32** is firmly in place on the top of sleeve **23**. The top plate **32** is provided with a plurality of vertically aligned holes **34** which correspond to and are respectively aligned with the axes of the cavities **27**, when the top plate **32** is in registry on the sleeve **23**.

When it is desired to cast a plurality of the pencils, i.e., the writing instruments, shown in FIGS. 1 and 2, the base plate **20** and the sleeve **23** are fitted appropriately together to form a cup. A prescribed amount of the water-extended polyester **40** for forming the casing **11** is then placed in the cup formed by the plate **20** and the sleeve **23**, as illustrated in FIG. 4. Thereafter, the die block **26** is passed downwardly through the sleeve **23**, so that it comes to rest upon the upper surface of the base plate **20**. This causes the emulsion **40** to be forced up through the various casting cavities **27**, without causing bubbles, as would occur if such an emulsion **40** were poured into the respective cavities from the top. Next, the top plate **32** is installed on the upper edge portion of the sleeve **23**, the upstanding alignment pins **30** being received in the recesses **31**. Thereafter, the graphite rods or "leads," such as core **10**, are inserted through the holes **34** in the top

plate **32** and passed downwardly along the axes of the cavities **26** so as to be received in the downwardly tapered recesses of base plate **20**. Since each recess **27** is downwardly tapered, forming an inverted cone, the cores, such as core **10**, are urged toward the center of each cavity **26** and therefore is held in alignment in the center of each such cavity **26**.

The emulsion **40** sets up in approximately one-half hour and, after this length of time has elapsed, the die of FIGS. 3, 4 and 5 may be disassembled and the pencils, thus produced, removed from their respective cavities. If the pencils are not of the right weight, i.e., they are heavy, the pencils may, if desired, be placed in an oven and baked out so that some of the water is evaporated from the pencil, thereby making the pencil lighter.

The material from which the casing **11** is made is known as a polymerized water-extended polyester.

The grain of core **10** is sufficiently rough that the emulsion projects into the crevices of core **10** and upon curing, the core **10** is firmly encased in the casing **11**. The casing **11** has an appropriate relatively rough exterior which enables the pencil to be grasped readily by a person writing.

One of the main advantages of the writing instrument of the present invention is that it can be manufactured less expensively than a wooden pencil and initial figures indicate to me that the cost will approximately be one-half the cost of a conventional wooden pencil. The writing instrument of the present invention, however, sacrifices none of the advantages of the wooden pencil and

may be readily colored, painted, or lacquered, and may be formed into a multiplicity of shapes. The surface may be printed or embossed, as desired.

It will be obvious to those skilled in the art that many variations may be made in the embodiments here chosen for the purpose of illustrating the present invention without departing from the scope thereof, as defined by the appended claims.

I claim:

1. A writing instrument comprising a graphite central writing core encased in a polymerized water-extended polyester resin, said casing containing from 40% to 80% by weight of water and comprising a plastic matrix having closed cells in which the droplets of water are encapsulated, said droplets of water being from 2 to 5 microns in size.

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LAWRENCE CHARLES, Primary Examiner

U.S. Cl. X.R.

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