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METHOD OF PRODUCING PENCIL LEAD

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3 Claims

ABSTRACT OF THE DISCLOSURE

A method of producing hard pencil lead by first mixing together graphite, carbon black, a synthetic resin, plasticizer, and solvent, then extruding the mixture into fine straight sticks. The sticks are subsequently baked for eight hours at 300° C. and then for one hour at 1000° C. so as to completely carbonize the resin.

This invention relates to a method of producing pencil lead which comprises adding graphite and carbon black to a synthetic resin, kneading the mixture thoroughly with the addition of a plasticizer and a solvent, forming the resulting mixture into pencil lead by molding through an extruder, heating the lead at a gradually increasing temperature in a furnace for a suitable period to burn at a high temperature, and finally oil treating the burned product.

Usually pencil lead in common use heretofore has been manufactured by mixing graphite, clay and other materials, burning the mixture and then allowing the burned product to be permeated with oil or fat. Thus, the manufacturing procedure requires many hours and special technical skill in selecting the clay and grinding such material. These factors may lead to the failure in producing finished products which are uniform in hardness, density, writing smoothness and other elements, and hence special serious difficulties are apt to accompany the manufacture in the conventional manner of fine or very hard lead to be used especially for sharp pencils since fine or very hard lead prepared by conventional means is found to be mostly brittle and unsuitable for the above-mentioned purpose.

Although various methods have been already proposed for using synthetic resins as direct substitutes for clay, they are mostly heat-hardened resins which not only fail to assure dimensional stability but also are found unsatisfactory in all points of density and coloring. In contrast, the present invention has been completed after research for a method which eliminates all the foregoing difficulties.

Pencil lead manufactured by the method of the present invention has the following characteristics.

(1) It is free from brittleness as is often the case with conventional products and moreover, it is strong and durable.

(2) Very fine or hard lead can be manufactured by simple adjustment of the lead density.

(3) A pencil using pencil lead of the present invention goes on to write smoothly and easily.

(4) Wear of pencil lead in writing is by far less than that of usual products.

(5) A pencil using pencil lead of the present invention goes on to write evenly (as the lead is made of a uniform and homogeneous material).

(6) Pencil lead is manufactured in a simple manner in the process of the present invention, the process being shorter in time and easier in procedure than any others heretofore.

The present invention will be explained with reference

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to one embodiment hereinafter which however does not restrict the scope of the present invention at all.

A mixture consisting of the following components, namely,

	Percent by weight
5 Graphite -----	20
Carbon black -----	5
Vinyl chloride resin -----	15
Plasticizer (D.O.P.) (di-octyl phthalate) -----	10
10 Solvent (methylethylketone) -----	50

is thoroughly kneaded by means of a roll. The mixture is extruded in straight form through an extruder, taken up by a roll and cut to suitable lengths in the form of fine straight-line sticks. Subsequently, said fine sticks are placed in an enclosed container such as a crucible which is then put in an oven. It is heated from a low normal extrusion temperature gradually rising up to 300° C. for a period of approximately 8 hours. If the temperature in the oven is increased suddenly at the end of this time, the mixture in the crucible tends to react so rapidly that the product becomes covered with blisters and lengthwise cracks as well.

These defects in turn affect the strength of the product, cause non-uniformity in quality between the central and circumferential portions of the lead, and give very poor touch and writing quality. Therefore, it is essential to overcome the above-mentioned difficulties so that the mixed material in straight-line form shall be heated first at a low extrusion temperature and then at a gradually increasing temperature up to 300° C. for a period of approximately 8 hours. The crude first form of pencil lead which has gone through the above steps is found still to have the followings defects because its resin content has been carbonized up to approximately 80 percent only at best.

(A) As the resin has not been carbonized completely, the lead proves to be of poor touch and irregular writing property.

(B) For lack of strength, the lead is brittle (with a hardness number less than 100° as determined by a pencil lead breakage tester of the usual type).

(C) The density of the lead is very low.

(D) The lead tends to be bent or deformed.

According to the present invention, the above defects are eliminated because the product is finished by further steps comprising burning or heating it at approximately 1000° C. for about one hour, cooling and permeating it with fluid paraffin.

In conventional processes for making pencil lead from graphite, carbon black and clay without the addition of a synthetic resin and in such conventional processes, the mixture is usually dried and then burnt at about 1000° C. but when a synthetic resin is contained therein in such conventional process, the mixture is heated to about 250° C. only which approximates the melting point of the resin used with the result that such lead has not been sufficiently hardened or carbonized for practical use.

Consequently, the usual known processes have been applied only to the manufacture of colored pencil lead which may be blue or red.

As explained hereinbefore, the present invention is characterized by mixing a synthetic resin specifically in the original mixture in the known process for making pencil lead which comprises drying of the mixture and burning or heating it at about 1000° C. and hence, the synthetic resin is well carbonized and combined with graphite, carbon black and other components to provide a very satisfactory lead. The product burned at 1000° C. and finished according to the present invention is more homogeneous, stronger in structure with a strength value hardness number of about 170° as determined by a

pencil lead breakage tester, touches and writes much more smoothly, has a better density and is less susceptible to bending or aging change in quality than usual known pencil lead gradually heated at 300° C. at best. The 170° means that the test shows 170 g./mm.², that is, a lead of 0.9 mm. diameter supported at two points with the span between these two points being 25 mm., breaks when a load of 170 g. is applied.

Synthetic resins suitable for use in the method of the present invention include vinyl chloride resin, styrol, silicone and other vinyl resins. Synthetic resins which can be reduced to carbon when burned are usable. Especially when vinyl chloride is used, the mixed material is carbonized to a greater extent than before and hence, will show greater resistance to breakage. Other synthetic resins such as acryl, melamine, phenol, urea, polyisobutylene, chloroprene rubber and polyester may also be used. Suitable known plasticizers and solvents can be selected depending on the type of resin to be used.

What is claimed is:

1. The method of producing hard pencil lead which consists in mixing together graphite, carbon black, a synthetic resin, a plasticizer and a solvent for said resin, kneading the mixture, extruding the kneaded mixture as fine straight sticks at a normal temperature, then heating said sticks at a gradually increasing temperature from the normal extrusion temperature up to a temperature of substantially 300° C. over a period of approximately eight hours, then further heating the mixture at substantially 1000° C. for about one hour to completely carbonize said resin, said plasticizer and solvent being so selected so that the mixture will be completely car-

bonize said resin, said plasticizer and solvent being so selected so that the mixture will be completely carbonized, and then cooling the product.

2. The method of claim 1, said resin being vinyl chloride resin.

3. The method of producing hard pencil lead which consists in forming a mixture containing graphite, carbon black, a resin and solvents and plasticizers, extruding said mixture under pressure to form a core, gradually heating said extruded core from a low normal extruding temperature to substantially 300° C. for substantially eight hours, and then heating said extruded core to about 1000° C. for approximately one hour to completely carbonize said resin.

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