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Draca

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[54] METHOD FOR THE PRODUCTION OF ABRASIVE BRUSHING ELEMENTS

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[51] **Int. Cl.**.....**C23b 7/00,** C23b 5/48

[58] **Field of Search**.....204/16, 23, 3, 4, 15, 27; 117/17, 26

[56] **References Cited**

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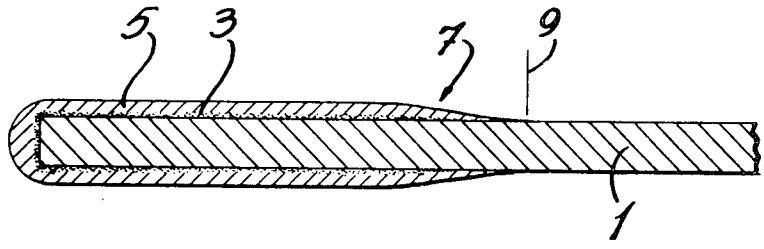
[57] **ABSTRACT**

An abrasive brushing element such as a wire bristle, a strip or a plate having the tip and a substantial portion thereof clad with a layer of a metal such as nickel, wherein is bound a layer or more of very fine abrasive powder, such as tungsten carbide. The article is produce by crushing a material of high hardness to a very fine particle size and imparting an electrostatic charge at the surface thereof. The fine particles are then caused to electrostatically adhere at the tip and along a substantial portion of the brushing element while metal plating, preferably with nickel at least that portion of the brushing element.

17 Claims, 2 Drawing Figures



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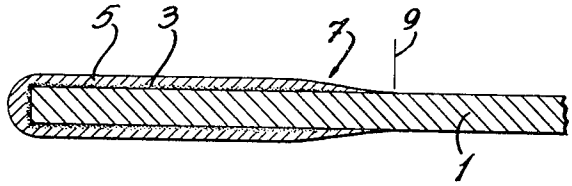

Fig. 1

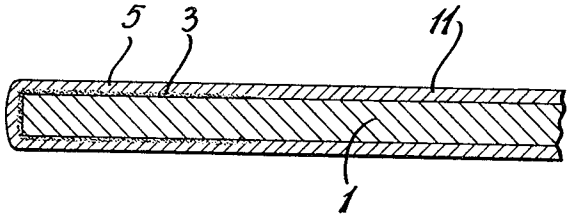

Fig. 2

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METHOD FOR THE PRODUCTION OF ABRASIVE BRUSHING ELEMENTS

This invention relates to a method for the production of abrasive brushing elements such as plates, strips and bristles used in the making of industrial brushes. More particularly, the invention relates to a bristle material presenting greater wear resistance, durability and abrasive power that hitherto used materials.

Most commonly, the bristles of industrial brushes are made of steel and particular stainless steel, and some present protective and/or strengthening metal coatings covering the surface of the wire. It is also known to make bristles of superior abrasive power by setting particles of abrasive compounds at the tips of the wires in the manner that diamonds are set in a diamond drill bit; such a solution was proposed for example in U.S. Pat. No. 2,608,034. Whereas it was found possible to set abrasive particles of manipulable sizes at the tips of wire bristles, the setting of similar granules elsewhere along the bristles would have been impractical as it would have necessitated excessive increase in the radial dimension of the wires with a resultant objectionable degree of stiffening.

The present invention proposes a solution that permits obtaining a uniform distribution of abrasive particles at and away from the tip of each wire without the aforementioned defects of the prior art reference.

The improved bristle of the invention consists of a metal wire, at least a portion of which is clad with an electrodeposited layer of metal wherein is bound a layer or more of very fine abrasive powder. Covering the tip of the wire bristle and the fine abrasive powder, is a coating of a metal, preferably nickel, which has been made by metal plating.

The method according to the invention therefore comprises crushing a material of high hardness to a particle size smaller than about 100 μ, imparting an electrostatic charge at the surface of the small particles of a material of high hardness, causing an amount of the electrostatically charged small particles to become electrostatically retained at the tip and along a substantial portion of a brushing element, and metal plating the brushing element which has small particles electrostatically retained thereon.

Through the preferred brushing element is a wire bristle preferably made of steel, it is understood that the present invention can also be applied to strips or plates or any other brushing elements used in industrial brushes.

The material of high hardness which is crushed to a small particle size, preferably 0.5 to 100μ, includes a carbide material. The term carbide material which is used throughout this disclosure and claims includes silicon carbide and preferably tungsten carbide. The commercially available product usually consists of a tungsten carbide and a nickel-cobalt binder; minor amounts of carbides of other refractory metals are often present particularly those of titanium and tantalum, but less frequently those of the other refractory metals such as columbium, molybdenum, vanadium, chromium, zirconium and hafnium. All such materials are characterized by their great hardness which is, in part, attributable to the hardness of the particular carbide. The practice of the invention is facilitated by the fact that the required carbide materials are generally available commercially; nevertheless, it must be understood that the invention also contemplates the possibility of utilizing all kinds of carbide materials.

Since only the tips of the brushing element is treated in the above manner, the remaining portions are usually masked by applying a commercial wax wherever suitable. The purpose of masking these portions of the brushing element is to confine the deposit of abrasive particles and the corresponding metal coating to a specific area which requires to be hardened.

After having masked the brushing element, it is recommended to clean the latter in a hot alkaline metal cleaner for a period of 2 to 3 minutes, to rinse the same thoroughly in hot water and to dry it in air before causing the small particles to become retained at the tip thereof.

The crushing of the material of high hardness is preferably carried out in a ball mill, the latter being capable of inducing alone electrostatic charges at the surface of the small particles. However, the electric charges on the small particles is imparted more successfully if an electrostatic powder gun is used to shoot electrons in a mass of small particles.

It is recommended to crush the carbide material to a particle size as small as possible, since then the same will adhere more easily, when electrostatically charged, to the brushing element.

In accordance with an embodiment of the invention, the electrostatically charged small particles are formed in a paste or slurry before being retained at the tip of the brushing element, and this is done by adding a non-electrolyte volatile liquid, such as isopropanol to the particles.

Metal plating may be carried out by dipping the brushing element having electrostatic charged particles of tungsten carbide or the like at the tip thereof, in a metal plating bath and allowing the metal, preferably nickel, to coat the tip of the brushing element. It is recommended to add a small amount of an activator to the metal bath. Preferably, this activator is nickel chloride which is added as an alcoholic solution containing 75 milligrams $NiC1_2$ per liter of alcohol. It is also believed that this activator helps to increase the life of the electrostatic charge in the suspension comprising the metal plating bath. In some cases, the galvanic effect produced when metal plating could cause the small particles to be removed from the tip of the brushing element. For this reason, a small quantity of an electric current is induced in the brushing element, and this quantity is only sufficient to retain the small particles at the tip of the brushing elements while preventing them from passing into the metal plating bath.

Generally, the brushing element is gradually introduced into the plating bath while applying the above small current, and at the same time gradually raising the voltage after the entire length of the portion to be plated has been dipped and subjected to initial plating at low density.

In the drawing which illustrates the invention,

FIG. 1 is a cross-section view of the tip of a stainless steel bristle treated by the process according to the invention,

FIG. 2 is the same view of the same stainless steel bristle plated along the entire length thereof.

Referring to FIG. 1, it will be seen that the wire bristle 1 is surrounded at the tip and along a substantial portion thereof with a large number of small particles of tungsten carbide 3. The whole is plated with nickel coating 5 and the gradually thinning out portion 7 is produced by first dipping the brushing element until it reaches the level 9 and gradually raising the bristle wire 1 to form this portion 7. The plated wire bristle is then suddenly removed from the metal plating bath.

In FIG. 2, the wire bristle 1 has a nickel coating which extends substantially past the portion containing the small particle of tungsten carbide 3. This portion 11 serves to define more stiffness in the wire bristle.

It is recommended to carry out the plating operation by keeping the bath cold, provided the temperature is not below 60° C.

I claim:

1. A method of producing abrasive wire bristle which comprises:
   a. crushing a material of high hardness to a particle size smaller than about 100 μ;
   b. imparting an electrostatic charge at the surface of the small particles of hard material;
   c. causing an amount of the electrostatically charged small particles to become electrostatically retained at the tip and along a substantial portion of said wire bristle; and
   d. metal plating said wire bristle having said small particles electrotatically retained thereon.

2. A method according to claim 1, in which said wire bristle is made of steel.

3. A method according to claim 1, in which said material of high hardness is a metal carbide.

4. A method according to claim 1, in which said metal carbide is tungsten carbide.

5. A method according to claim 1, wherein said material having high hardness is crushed to a particle size in the range between about 0.5λ to about 100λ.

6. A method according to claim 1, wherein said crushing is carried out in a ball mill, which induces said electrostatic charges at the surface of said small particles.

7. A method according to claim 1, wherein said electric charge is imparted to said small particles by an electrostatic powder gun.

8. A method according to claim 1, wherein wax is applied to said wire bristle to mask the portions of said wire bristle where small particles and metal plating are undesired.

9. A method according to claim 8, and comprising cleaning and drying said wire bristle before causing said small particles to become electrostatically retained thereon.

10. A method according to claim 1, wherein said electrostatically charged small particles are formed into a paste or slurry by adding thereto a non-electrolyte volatile liquid before being retained at the tip of said wire bristle.

11. A method according to claim 1, wherein said metal plating is carried out by dipping in a metal plating bath said wire bristle having said small particles electrostatically retained thereon.

12. A method according to claim 11, wherein said metal plating bath also contains a small amount of an activator.

13. A method according to claim 12, wherein said activator is nickel chloride.

14. A method according to claim 10, wherein said volatile liquid is isopropyl alcohol.

15. A method according to claim 11, wherein said metal plating is carried out while applying a small current to said wire bristle, said current only sufficient to retain said small particles on said wire bristle, while preventing the same from passing into the metal plating bath.

16. A method according to claim 1, wherein said wire bristle is plated with nickel, on the entire length thereof.

17. A method according to claim 15, wherein the tip of said wire bristle is gradually introduced into the plating bath, while gradually raising the voltage after the entire length of the portion to be plated has been dipped and subjected to initial plating at low density.

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