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CUTTING AND GRINDING TOOLS

Walther Dawihl, Kohlhasenbruck, near Berlin, Germany, assignor to General Electric Company, a corporation of New York

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It is known to produce grinding tools, for instance hand lapping devices or straightening tools for grinding disks by sintering together diamond powder of suitable grain size with hard metal alloys. The hard metal alloy which serves as the binder for the diamond grains in that case consists generally of a mixture of a carbide with a high melting point, preferably tungsten carbide, and a metal with a low melting point, mainly cobalt. Tools of such mixtures are of high quality but a disadvantage exists in their use in that the surface of the cutting or grinding grains embedded in the metallic binder alloy gradually deteriorates. This phenomenon may be due to the fact that the binder alloy, under the influence of the operating pressure and the temperature, becomes plastic and starts to flow. The flow process leads to a covering of the operating edges of the diamond grains and thereby prematurely reduces the capacity of the tool.

It can be concluded from these observations that the binder alloy is of great importance for the functioning of the hard cutting or grinding grains. On the other hand, it may be concluded that the use of metals with a low melting point such as cobalt, which constitutes a metal with a relatively good plastic deformation, is mainly responsible for the premature reduction of the grinding capacity of such tools.

The metallic binder for the hard cutting or grinding grains which amount to 5 to 25 per cent of the total mixture, and which may consist of boron carbide grains or silicon carbide grains in addition to the diamond grains, consists according to the present invention of a chemical compound of cobalt, tungsten and carbon in accordance with the formula Co_3W_3C. Thorough chemical and metallographic investigations have shown that this particular chemical compound of cobalt, tungsten and carbon has such a small tendency toward flowing that a covering of the operating edges of the grinding grains by the binder is avoided. Moreover this compound has such a high hardness that it is not removed prematurely during the operating process. Cutting and grinding tools which are manufactured according to the invention with the application of the compound Co_3W_3C as the binder therefor retain their capacity in a uniform manner until the natural dulling of the grinding grains subsides. In the melting process the binder alloy to be used according to the invention greatly resembles pure cobalt so that the known operating methods for the manufacture of cutting tools and grinding tools as well as implements of various types, can be used for the new binder alloy. It was further found that the cobalt in the compound Co_3W_3C can be replaced either entirely or partly by suitable quantities of nickel, iron or manganese while the favorable properties of this compound are retained.

In order to adapt the tools or implements produced according to the invention to the different applications, as far as their properties go, it is possible to add to the chemical compound Co_3W_3C which is used as the binder alloy, additional carbides of metals with a high melting point. The corrosion resistance of such alloys can for instance be improved against the influence of the temperatures occurring during operation by adding tungsten carbide and/or titanium carbide to the alloys. The added quantity of such carbides can in that case amount up to three times the actual binder alloy.

The manufacture of the above-mentioned compound Co_3W_3C or the corresponding nickel, iron or manganese compounds, can take place by mixing the individual materials and sintering or melting them together until the reaction occurs. The converted mass is then crushed and ground.

As an example for the composition of cutting tools or grinding tools according to the invention, the following mixtures may be mentioned:

Example 1

	Parts by weight
Compound Co_3W_3C	85
Diamond powder 60–100 μ	15
	100

Example 2

	Parts by weight
Compound Ni_3W_3C	90
Boron carbide 20–60 μ grain size	10
	100

Example 3

	Parts by weight
Compound Co_3W_3C	40
Tungsten carbide	30
Titanium carbide	10
Diamond powder 300–500 μ grain size	20
	100

These mixtures are pressed in a known manner or formed according to other methods, whereupon they are sintered at temperatures between 1300 and 1700° C. The sintering can take place without mechanical pressure but it is also pos-

sible to place the mixtures in carbon molds and heat the mixture therein under pressure until the sintering is completed. The carbon mold may have a shape corresponding to the desired molded bodies, for instance corresponding to a grinding ring, a rectangular cutting tip or a round straightening tool.

Alloys of the above-mentioned composition may serve as grinding disks, for instance for finishing hard metals, glasses or other hard materials, or grinding tools of other types, like manual lapping tools, straightening tools and also for cutting tools which are used for turning, boring or milling.

The grain size with which the diamond, the boron carbide or the silicon carbide is to be used, depends on the purpose for which the tool will be used. For rough turning or finishing work, grains up to 1 mm. can be utilized.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A tool consisting of diamonds and a metallic binder, characterized by the fact that the metallic binder consists of a chemical compound of cobalt, tungsten and carbon in accordance with the formula Co_3W_3C.

2. A tool consisting of diamonds and a metal binder therefor, said binder having a formula X_3W_3C in which X represents metal of the iron group.

3. A tool according to claim 1, characterized by the fact that high melting point carbides are added either individually or in mixtures, to the mixture of diamonds and binding metal, in order to adapt the material for different purposes, said carbide addition comprising up to about three times that of the compound Co_3W_3C and said diamonds constituting about 5 to 25% by weight of said tool.

4. A tool comprising hard cutting particles embedded in a metallic binder therefor, said tool being characterized by the fact that said binder is a chemical compound having the formula Co_3W_3C.

WALTHER DAWIHL.