

UNITED STATES PATENT OFFICE

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CEMENTED HARD CARBIDE MATERIAL

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3 Claims. (Cl. 75-1)

This invention relates generally to hard cemented carbide materials made by a cementing or sintering process, and more particularly to such materials containing tungsten carbide, tantalum carbide, titanium carbide and an auxiliary metal or alloy such as cobalt, iron or nickel.

Hard cemented carbide materials containing tungsten carbide and iron, cobalt, or nickel are now known and have been described in Schroeter Patent No. 1,549,615.

In my application, Serial No. 572,977, filed November 4, 1931, there is described a hard cemented carbide material containing tungsten carbide, tantalum carbide and cobalt, nickel or iron. This composition exhibits less wear when used as a tool for cutting steels than the composition of the Schroeter Patent. It has a lower heat conductivity and has less tendency to form the detrimental chip cavity behind the cutting edge of the tool than the Schroeter material.

It also has been proposed to use a mixture of tungsten carbide, titanium carbide, and an auxiliary metal. Although this composition, like the composition described in my application Serial No. 572,977, exhibits reduced wear and has a lower heat conductivity than the Schroeter composition containing tungsten carbide and cobalt, the composition containing tungsten carbide, titanium carbide and cobalt is more brittle and the commercial product has a tendency to exhibit free graphite which reduces the hardness and strength of the material.

I have found that a superior composition can be made by cementing a mixture of tungsten carbide, tantalum carbide, titanium carbide and an auxiliary metal such as cobalt, iron or nickel. This composition has a lower heat conductivity and affords a further resistance to wear and to the formation of chip cavity when used as a tool material, as compared with any of the other compositions referred to. These properties are obtained at little or no increase in the brittleness of the composition and in some cases produces a toughening effect. In addition, the composition produces a bright, smooth cut on the material being machined when it is employed in the high speed machining of steel.

In carrying out the invention, tungsten carbide, tantalum carbide, titanium carbide and either cobalt, iron or nickel or a mixture of these auxiliary metals, but preferably cobalt, are mixed together by milling them in a ball mill in accordance with the usual process in preparing finely divided materials for sintering. This mixture may be sintered or cemented by either the

cold-press method or the hot-press method. In the cold-press method the mixture is compacted into a billet under relatively high pressure, for example 10,000#/sq. in. and is then preferably given a preliminary sinter at about 1600° F. It is cooled and reshaped and then given a final sinter at a temperature of between 2600 and 3200° F.

The material may be made according to the hot-press method in which the heat and pressure are applied simultaneously. We prefer in the hot-press method to use a temperature of about 3200° F. and a pressure of about 1400#/sq. in. and to carry out the sintering for about five minutes at this temperature. Other temperatures and pressures may, however, be used satisfactorily according to the particular composition.

The percentages of tungsten carbide, tantalum carbide, titanium carbide and auxiliary metal may be varied within wide limits and still produce satisfactory results. The tungsten carbide may vary between 35 and 80% by weight of the entire mixture, but it is preferably between 50 and 70%. The tantalum carbide may vary between 5 and 45%, but preferably is between 10 and 35%. The titanium carbide may vary between 5 and 30% and preferably between 3 and 20%. The auxiliary metal, preferably cobalt, may vary between 1 and 30% and is usually maintained between 5 and 15%.

A composition which I have found to exhibit very superior properties contains: tungsten carbide 57.96%, tantalum carbide 24.84%, titanium carbide 10%, cobalt, iron or nickel 7.20%.

The tungsten carbide generally is used in greater proportion than either the tantalum carbide or the titanium carbide, and the tantalum carbide is generally used in higher proportions than the titanium carbide. Furthermore, the titanium carbide usually increases with the amount of auxiliary metal.

It is to be understood that one or more auxiliary metals may be used in place of a single auxiliary metal. The term "auxiliary metal" is used in a broad sense to cover not only the metal *per se*, but also alloys formed between the auxiliary metals themselves when more than one auxiliary metal is used or between an auxiliary metal and the hard metal carbide or carbides.

I have described the present preferred embodiment of my invention. It is to be understood, however, that the invention may be otherwise embodied within the scope of the following claims.

I claim:

1. A hard cemented carbide material containing about 35 to 80% tungsten carbide, about 5 to 45% tantalum carbide, and about .5 to 30% titanium carbide, the remainder consisting essentially of an auxiliary metal of the group consisting of cobalt, iron and nickel in the range of about 1 to 30%, the proportion of tungsten carbide being greater than either the tantalum carbide or titanium carbide.
2. A hard cemented carbide material containing about 50 to 70% tungsten carbide, about 10

to 35% tantalum carbide, and about 3 to 20% titanium carbide, the remainder consisting essentially of an auxiliary metal of the group consisting of cobalt, iron and nickel in the range of about 5 to 15%.

3. A hard cemented carbide material containing about 58% tungsten carbide, about 25% tantalum carbide, about 10% titanium carbide, and about 7% of an auxiliary metal of the group consisting of cobalt, nickel and iron.

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15	90
20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150