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SINTERED HARD METAL ALLOYS

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My invention relates to sintered hard metal alloys of the class described in my co-pending patent application, Serial Number 89,469, filed July 7, 1936.

This co-pending application has reference to sintered hard metal alloys which contain, besides 0.5–20% auxiliary metal, that is cobalt, nickel, iron, manganese, separate or in combination, or alloys thereof, for example with tungsten, molybdenum or chromium, further 3 to 30% titanium carbide, 0.3 to 10% vanadium carbide and the balance tungsten carbide, and in which the content of titanium carbide at any rate should be higher than that of vanadium carbide.

These alloys are eminently suited for the various kinds of steel machining, particularly in executing smoothing work. The best results are obtained with contents of auxiliary metal of 3–10%, of titanium carbide of 5–20%, and of vanadium carbide of 0.5–5%.

I have now found that similar good results in machining steel, in particular in smoothing operations, are obtained with alloys of the character described in which the vanadium carbide is replaced at least partly by vanadium boride or vanadium nitride. I have further discovered, that these alloys can be further altered by replacing the titanium carbide at least partly by titanium nitride. If maximum capacities are desired, it is advisable, too, to replace the vanadium carbide at the outmost up to the half by vanadium boride or vanadium nitride. The same is the case in replacing the titanium carbide by titanium nitride, if such substitution is to be made at all.

The preferred ranges for the individual alloy components are in the present case again: for the auxiliary metal 3–10%, for the content of vanadium compounds 0.5–5%, and for the content of titanium compounds 5–20%, within which ranges for peak efficiencies come into consideration the ranges of 5–7% for the content of auxiliary metal, of 0.5–2% for the vanadium compounds and 13–17% for the titanium compounds.

The following examples of my present new alloys may be given:

	Per cent
I. Vanadium carbide	1.0
Vanadium nitride	0.5
Titanium carbide	15.0
Cobalt	5.5
Balance tungsten carbide.	

	Per cent
II. Vanadium nitride	2.0
Titanium carbide	10.0
Titanium nitride	4.0
Cobalt	6.0
Balance tungsten carbide.	

	Per cent
III. Vanadium carbide	2.0
Vanadium boride	1.5
Titanium carbide	2.0
Titanium nitride	15.0
Cobalt	5.0
Balance tungsten carbide.	

	Per cent
IV. Vanadium boride	3.0
Titanium carbide	19.0
Nickel	7.0
Balance tungsten carbide.	

The manufacture of my new alloys takes place preferably by intimately mixing finely powdered tungsten carbide with likewise finely powdered auxiliary metal and, further, with the likewise finely powdered vanadium compounds and powdered titanium compounds in the proportions desired in the special case, whereupon the mixture is compressed and subsequently, or simultaneously with the compressing operation, is sintered in known manner.

What I claim and desire to secure by Letters Patent is:

1. A sintered hard metal composition containing one or more vanadium compounds, said compounds including vanadium boride and vanadium nitride, one or more compounds from the group titanium nitride, titanium carbide, about 3 to 20% of auxiliary relatively low melting point metal with the remainder tungsten carbide, the total quantity of vanadium compounds present in the composition varying from about 0.5 to 5% and the total quantity of titanium compounds present in the composition varying from about 5 to 20%.

2. A sintered hard metal composition containing one or more vanadium compounds, said compounds including vanadium boride and vanadium nitride, one or more compounds from the group titanium nitride, titanium carbide, about 3 to 20% of auxiliary relatively low melting point metal with the remainder tungsten carbide, the total quantity of vanadium compounds present in the composition varying from about 0.5 to 2% and the total quantity of titanium compound present in the composition varying from about 13 to 17%.

3. A sintered hard metal composition contain-

ing vanadium carbide, and vanadium boride, about 5 to 20% of titanium carbide, about 3 to 20% of an auxiliary relatively low melting point metal, the remainder being tungsten carbide, the total vanadium carbide and vanadium boride content of the composition varying from about 0.5 to 5%.

4. A sintered hard metal composition containing vanadium carbide, vanadium boride, titanium carbide and titanium nitride, about 3 to 20% of an auxiliary relatively low melting point metal, the remainder of the composition being tungsten carbide, the vanadium carbide and vanadium boride content of the composition varying from about 0.5 to 5% and the titanium carbide and titanium nitride comprising about 5 to 20% of the content of the composition.

5. A sintered hard metal composition containing vanadium carbide and vanadium nitride, about 5 to 20% of titanium carbide and about 3 to 20% of auxiliary relatively low melting point metal with the remainder tungsten carbide, the total vanadium carbide and vanadium nitride content of the composition varying from about 0.5 to 5%.

6. A sintered hard metal composition containing substantially equal quantities of vanadium carbide and vanadium boride, the total quantity of vanadium carbide and vanadium boride present in the composition varying from 0.5 to 5%, about 5 to 20% of titanium carbide, about 3 to 20% of auxiliary relatively low melting point metal, with the remainder tungsten carbide.

7. A sintered hard metal composition containing substantially equal quantities of vanadium carbide and vanadium boride and substantially equal quantities of titanium carbide and titanium nitride, the total quantity of vanadium carbide and vanadium boride present in the composition varying from about 0.5 to 5%, the total quantity of titanium carbide and titanium nitride present in the composition varying from 5 to 20% about 3 to 20% of auxiliary relatively low melting point metal, with the remainder tungsten carbide.

8. A sintered hard metal composition containing substantially equal quantities of vanadium carbide and vanadium nitride, the total quantity of vanadium carbide and vanadium nitride present in the composition varying from about 0.5 to 5%, about 5 to 20% of titanium carbide, about 3 to 20% of auxiliary relatively low melting point metal, with the remainder tungsten carbide.

9. A sintered hard metal composition containing one or more compounds from the group titanium carbide, titanium nitride, vanadium carbide and one of the compounds from the group vanadium boride and vanadium nitride, about 3 to 20% of auxiliary, relatively low melting point metal with the remainder tungsten carbide, the total quantity of vanadium compounds present in the composition varying from about 0.5 to 5% and the total quantity of titanium compounds present in the composition varying from about 5 to 20%.

10. A sintered hard metal composition containing one or more compounds from the group titanium carbide, titanium nitride, vanadium carbide, and one of the compounds from the group vanadium boride and vanadium nitride, about 3 to 20% of auxiliary, relatively low melting point metal with the remainder tungsten carbide, the total quantity of vanadium compounds present in the composition varying from about 0.5 to 2% and the total quantity of titanium compounds present in the composition varying from about 13 to 17%.

11. A sintered hard metal composition containing about 1% vanadium carbide, about 0.5% vanadium nitride, about 15% titanium carbide, about 5.5% cobalt with the remainder tungsten carbide.

12. A sintered hard metal composition containing about 2% vanadium carbide, about 1.5% vanadium boride, about 2% titanium carbide, about 15% titanium nitride, about 5% cobalt with the remainder tungsten carbide.

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