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HARD METAL COMPOSITION

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This invention relates to a hard metal alloy, in particular for tools and other working appliances.

More in particular, the invention is concerned with hard metal tool alloys containing tantalum carbide in considerable amounts.

It is an object of the invention to improve the hardness of hard metal alloys containing tantalum carbide in substantial amounts.

It is another object of the invention to produce a hard metal alloy of improved hardness and toughness containing tantalum carbide in considerable amounts.

It is still another object of the invention to render hard metal tool alloys containing tantalum carbide in considerable amounts suitable for machining steel and other materials which, like steel, give long chips when machined.

These and other objects of the invention will be more clearly understood when the specification further proceeds.

In the production of hard metal tool alloys, in particular for machining long chip forming materials such as steel, many attempts were made to produce alloys being as hard as possible and of the lowest possible heat conductivity. Such materials, as experience has shown, are most suitable for turning, milling, planing and similar chip forming machine work.

Hard metal alloys have been suggested for this purpose consisting substantially of tungsten carbide, and it was suggested to add titanium carbide in order to improve the properties of these alloys referred to above. It has also been suggested to add to these carbides various other hard carbides which have proven to some extent suitable for the purposes referred to above.

In particular, hard metal alloys have been suggested containing considerable amounts of tantalum carbide which was cemented by suitable auxiliary metals, imparting toughness to the alloy. Such hard metal alloys were, however, of relatively little hardness.

According to the present invention, a hard metal alloy for tools and other working appliances is made of a major portion of tantalum carbide and/or niobium carbide (which is also called columbium carbide) whereas a minor portion of the alloy consists of titanium carbide, tungsten carbide and/or molybdenum carbide. Of these carbides which are to be present as a minor portion of the alloy, titanium carbide is always present in an appreciable amount. Of the other carbides there may be present about 1% to 20%.

These carbides are combined with tough auxiliary metal, preferably of the iron group, thou other metals such as chromium may be added small amounts. Auxiliary metal should be pre ent in amounts of about 2% to 20%.

In the preferred form of the invention t hard metal alloy is sintered, and the auxilia metal substantially cements the carbide.

Although the alloy can be manufactured in a desired way it may be mentioned that first t carbide may be formed, then comminuted a admixed to the powdery auxiliary metal wher upon the mixture can be pressed and shaped a highly sintered.

The carbide may be combined into mixed cry tals, which are a solid solution, before the au iliary metal is admixed, or the formation of solid solution of the carbides may be caused permitted to some extent during the sinteri process.

In particular, if tantalum carbide and niobiu carbide are used, they can be transformed in mixed crystals entirely or to a substantial exter for instance, at least 10% of these carbides shou be transformed into mixed crystals.

It is to be understood, however, that the i vention is not limited to the use or formation mixed crystals.

Niobium carbide is of properties similar those of tantalum carbide. Indeed, niobium pe tains to the same chemical group as tantalu does and therefore has quite similar characte istics.

Therefore, niobium carbide can be substitut in part, for tantalum carbide for the purposes this invention. It has been proven particula suitable to form mixed crystals of these carbid Such mixed crystals of carbides exceed as to th hardness that of the components.

In order to suit hard metals containing tant lum carbide to various demands, other carbid may be added besides titanium carbide where either the heat conductivity, or the resistan against oxidation, or hardness, or toughness, other characteristics of the alloy can be affect individually or simultaneously.

If, for instance, molybdenum carbide is add the average hardness of the carbide present increased. If tungsten carbide and chromiu carbide are added, the toughness of the all can be increased whereas zirconium carbide, added, somewhat reduces the heat conductivi Sometimes also small additions of vanadium ca bide are of advantage.

Such additional carbides can be present amounts up to about 20%. If two of such ca

ıre added simultaneously, their total, on rage, may amount to not more than 20%. following are compositions which have advantageous in practice in one or the espect.

Example 1

	Per cent
ım carbide	50
ım carbide	25
enum carbide	10
	15

alloy is of great hardness and particularly for fine grinding or turning steel.

Example 2

	Per cent
ım carbide	60
ım carbide	5
n carbide	11
en carbide	20
	4

sintered alloy is of particular toughness ited for use in machines which are liable ıte.

articular, this alloy can be used in older ıes.

to be understood that the invention is not to any of the examples and combinations ıbove.

understood by anybody skilled in the art ıe or the other property of the alloys re- to can be affected, i. e., increased or de- l by proper proportioning of the com- . In particular, by varying the content lliary metal the general characteristics of oys given above are not as much affected resistance to breakage of the alloys which can be decreased or increased by proportioning the amount of auxiliary metal.

What I claim is:

1. A sintered hard metal alloy, particularly adapted for tools and other working appliances, substantially consisting of about 60% tantalum carbide, about 5% titanium carbide, about 11% niobium carbide, about 20% tungsten carbide and about 4% auxiliary metal substantially of the iron group.

2. A hard metal composition, particularly adapted for tools and other working appliances, substantially consisting of 50% to 91% tantalum carbide and niobium carbide, 8% tantalum carbide and 11% niobium carbide as a minimum, about 5% to 20% titanium carbide and about 1% to 20% carbide selected from a group consisting of tungsten carbide and molybdenum carbide, said carbides of normal crystalline structure and present in finely divided state, and about 2% to 20% auxiliary metal of the eighth group of the periodical system and substantially selected from the iron group thereof.

3. A sintered hard metal composition, particularly adapted for tools and other working appliances, substantially consisting of 50% to 91% tantalum carbide and niobium carbide, 8% tantalum carbide and 11% niobium carbide as a minimum, about 5% to 20% titanium carbide and about 1% to 20% carbide selected from a group consisting of tungsten carbide and molybdenum carbide, said carbides of normal crystalline structure combined into mixed crystals in substantial amount and present in finely divided state, and about 2% to 20% auxiliary metal of the eighth group of the periodical system and substantially selected from the iron group thereof.

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