

UNITED STATES PATENT OFFICE

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ALLOY

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5 Claims. (Cl. 75-171)

My invention relates to alloys suitable for use in the manufacture of high speed cutting tools and particularly to improvements in alloys of the character described in my earlier patents, Nos. 1,698,934, 1,698,935 and 1,698,936.

In high speed tool alloys of the character described in such earlier patents hard metallic carbides, such as those of tungsten and chromium, are embedded in a tough, hard, metallic matrix of cobalt and nickel. Such an alloy possesses unusually advantageous characteristics for use as a high speed cutting tool. It is self-hardening. It also possesses the characteristics of retaining its hard cutting character when heated to a high heat. It possesses a high degree of abrasive hardness.

The present invention relates to the production of such an alloy which possesses unusually high efficiency and effectiveness for the purpose intended. The carbide crystals of the present improved alloy are particularly hard and abrasive and possess unusually high cutting efficiency. The alloy not only retains its high effectiveness when heated to a high temperature but it is tough and strong and resistant to breakage, flaking, or splintering.

I have found that if titanium be substituted for part of the tungsten used in the alloy that the carbide crystals are particularly dense and tough and wear resistant and abrasive to a very high degree and possessed of unusually long life. In those instances where titanium has heretofore been used as an ingredient in alloy steel, the titanium went into solution in the mass of the steel. So far as I am aware, however, I am the first to suggest its use and recognize its value in an alloy of the character herein set forth where the cutting abrasive characteristics of the alloy are provided by the carbide crystals which are embedded in the matrix, and where the titanium is employed to densify, harden and increase the abrasive resistance of the cutting tool.

My improved alloy comprises cobalt which may vary from 35% to 55%. A preferred range is around 43% to 45%. Nickel might be substituted for a part of the cobalt if desired and this has heretofore been done, but the matrix is less hard than if the nickel were not so substituted. The cobalt and, if nickel is used, the cobalt and nickel, constitute the major portion of the matrix in which the carbide crystals are embedded. Such matrix is tough and hard and resistant but it is the embedded carbides which perform the cutting action. Carbon is added in an amount

which may vary from 1.75% to 2.75% but preferably in an amount around 2.25%.

Metals of the chromium group are added to form hard carbides. I find it desirable to employ chromium in an amount which may vary from 25% to 45%, but preferably around 33% to 35%. Tungsten, also from this chromium group is added in an amount which may vary from 10% to 20% but preferably around 15% to 16%. A small amount of boron, for example, from 0.10% to 0.28%, and preferably around 0.16% to 0.20% has been found very desirable and is employed.

I have found that if, to the above ingredients, I substitute titanium for a part of the tungsten the character of the carbide crystals and their cutting efficiency is definitely improved. I prefer to employ titanium in an amount less than 6%, for example, around 2.5% to 3.0% has been found satisfactory. Such amount of titanium appears to impart to the metallic carbides a hard dense highly abrasive cutting nature and unusually long life. The titanium is preferably integrated in the mass as a chromium titanium carbon alloy and the carbon may also be integrated therein as a carbide of one or more of the metals. In my improved alloy the carbide content may constitute as much as 55% of the alloy with the matrix constituting the remainder. Certain other ingredients may be present. A small amount of manganese, for example from 0.50% to 0.75% may be used. This manganese is ordinarily present as an impurity and the above amounts should not be considered limits though it is not desired to exceed 1%, but its presence in a small amount appears to be beneficial. A small amount of silicon, for example, around 0.25% may be added and this also may be present merely as an impurity.

An alloy consisting of:

	Per cent
Cobalt.....	43
Chromium.....	33
Tungsten.....	16
Titanium.....	2.50
Carbon.....	2.25
Manganese.....	.75
Boron.....	.18
Silicon.....	.25
Fe.....	Balance

has been found highly efficient. A small amount of iron may be present in the alloy without detriment and would probably be present as an impurity though it is not the intention to add the same specifically. Molybdenum might be substi-

tuted for a part of the tungsten though it is not the intention so to do.

What I claim is:

1. An alloy consisting substantially of cobalt
- 5 38% to 48%, chromium 28% to 38%, tungsten not varying greatly from 15% to 16%, carbon not varying greatly from 2.25% to 2.75%, boron not varying greatly from 0.18% to 0.20%, and titanium not varying greatly from 2.50% to 3%.
- 10 2. An alloy consisting substantially of cobalt not varying greatly from 43%, chromium not varying greatly from 33%, tungsten not varying greatly from 16%, carbon not varying greatly from 2.25%, boron not varying greatly from
- 15 .18%, titanium not varying greatly from 2.50%.
3. An alloy consisting substantially of cobalt

35% to 55%, chromium 25% to 45%, tungsten 10% to 20%, carbon 1.75% to 2.75%, boron 0.10% to 0.28%, and titanium not to exceed 6%.

4. An alloy consisting substantially of cobalt 35% to 55%, chromium 25% to 45%, tungsten 5 and molybdenum jointly 10% to 20%, carbon 1.75% to 2.75%, boron 0.10% to 0.28%, and titanium 2.5% to 6%.

5. An alloy consisting substantially of cobalt not less than 43%, chromium 25% to 35%, tung- 10 sten not to exceed 16%, titanium not to exceed 3%, carbon not to exceed 2.75% and boron not to exceed 0.20%, to constitute approximately 100%.

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