

UNITED STATES PATENT OFFICE

2,048,239

ALLOY

Roy T. Wirth, East Cleveland, Ohio

No Drawing. Application November 14, 1929,
Serial No. 407,296

1 Claim. (Cl. 75-136)

The present invention relates to extremely hard alloys which are particularly adapted for use in the manufacture of high speed cutting tools or implements subject to abrasion although they may be used for various other purposes. The alloys are made up of chromium, carbon, and one or more of the other metals of the chromium group, preferably either tungsten or molybdenum alone or a combination of the two. The composition of such alloys may be varied within wide limits, but within these limits furnishes alloys of extreme hardness and alloys which are useful in the manufacture of cutting tools or similar implements. In addition the present invention includes a method of using such high carbide alloys and in forming cutting tool alloys having definite limits of composition by the addition of the above type of carbide alloy to a second alloy of a different composition.

In my co-pending applications, Serial No. 81,085, filed Jan. 13, 1926; and Serial No. 448,433, filed Apr. 29, 1930; I have described alloys using chromium in combination with carbon, and one or more of the metals of the iron group, preferably cobalt. In the present invention; which is a continuation in part of my applications, Serial No. 81,085, filed Jan. 13, 1926; Serial No. 448,433, filed Apr. 29, 1930; Serial No. 405,540, filed Nov. 7, 1929; and Serial No. 408,414, filed Nov. 19, 1929; I have found that by changing the composition, that is, by alloying chromium, carbon and one or more of the other metals of the chromium group, such as tungsten or molybdenum, it is possible to produce even harder alloys which, while useful in themselves for some purposes, are even more useful to add to other alloys to obtain a desired, definite, final alloy.

The alloys contain chromium, carbon and tungsten, chromium, carbon and molybdenum, or chromium, carbon, tungsten and molybdenum, and the following analyses give typical examples of such alloys.

Chromium	Carbon	Tungsten and/or molybdenum, cobalt, etc. and impurities
42.50	8.10	49.40
33.76	5.85	60.39
21.24	3.64	75.12
65.23	5.62	29.15
75.06	12.32	12.62

It will be seen from the analyses that the carbon varies from about three percent to 12½ percent. The chromium can likewise be varied

from as low as 10 percent to as high as 75 percent, while the tungsten or molybdenum or the combination thereof may likewise be varied from 20 percent to nearly 90 percent. The carbon content increases with the chromium content inasmuch as the maximum amount of carbon which can be dissolved in and/or combined with tungsten without forming graphite is less than the amount of carbon which can be dissolved in and/or combined with chromium without forming graphite.

In making such alloys, particularly where high carbon contents are employed, it is preferable to use the elements in the powdered form, and to mix them together in the desired proportions and then to press slugs of the mixed powders, a suitable binding material being added to hold the powders in shape, if desired. The pressed slugs are then heated or fused to form the final alloy. These alloys can also be made by using the metallic carbides, such as exist in the final alloys, in the powdered form. Where this is done, the carbides are formed separately, powdered to a suitable fineness, mechanically mixed with chromium, tungsten, carbon, or powdered alloys thereof, and then sintered or melted to form the final alloy.

In alloys of the present type, it is to be understood, of course, that the usual impurities are present; that is, that there may be small quantities of other metals such as iron, or the like, and also that special elements such as titanium, zirconium, tantalum, and the like, may be added in small quantities to give special properties to the alloys, and that where such special elements are added they are in such small quantities that the main alloy is always substantially a composition of chromium, carbon, and one or more of the other metals of the chromium group. Cobalt, or one or more of the metals of the iron group may be present up to 10 percent, but where present, must be held low enough not to affect the carbide formation of the alloy.

In using these alloys which are essentially a carbide alloy, that is, the alloy is essentially composed of carbides of the metals present, they can be mixed with other alloys to produce final alloys of definite compositions. In making such final or mixed alloys it has been found that where a carbide or a carbide alloy of the type previously described is added to a second alloy, that excellent results are obtained where the second alloy contains the metal or metals of the first carbide alloy as well as metals of a different group. It has likewise been found that if a straight metallic carbide is used, such as either chromium or tung-

sten carbide, it may be advantageously added to a molten alloy containing the metal of the carbide and another metal. Such carbide alloys are hereinafter designated as "A" metals. These "A" metals may be added or mixed with "B" metals which should contain the metal or metals of the essential carbide or carbides of the "A" metal together with a metal or metals of another group, preferably metals of the iron group such as cobalt, the "B" metal containing carbon as well, but preferably an insufficient amount of carbon to have a particularly high carbide content. The following examples are given:

"A"		"B"	
Carbon	8.5-9	Chromium	24-28
Chromium	55-60	Tungsten	12-18
Tungsten	}	Cobalt	64-54
and		Carbide	Low as possible
Impurities	32-36		

Resultant

Carbon	3 1/4-9
Chromium	38-58
Tungsten	}
and	
Cobalt	Balance (not less than 15 percent)

"A"		"B"	
Chromium	12 1/4-15	Chromium	7-8
Tungsten	75-80	Tungsten	38-42
and	}	Cobalt	}
Carbon		Impurities	
	6 1/4-7	Low carbon	Balance

Resultant

Carbon	1-7
Chromium	7 1/4-15
Cobalt	Not less than 5 percent
Tungsten	Not less than 38 percent

Thus the present alloy as well as the method of using the same gives unusual results, and particularly the method is the adding of an "A" metal, that is, a metal composed essentially of metallic carbides to a "B" metal which is an alloy composed of the metal or metals in the "A" metal together with a metal of another group which is preferably a metal of the iron group. The "B" metal is preferably melted as this can be readily done where the "B" metal does not contain a high carbide content, and the "A" metal is then added, and the two mixed to form

the resultant alloy. In such mixing operation it is often desirable to powder the "A" metal, press into slugs, and to add such slugs to a molten or fused bath of the "B" metal and then thoroughly mix before pouring, casting, or cooling the resultant alloy.

In addition an "A" metal may also be added to a "B" metal where the two metals both contain the same carbide such as the following:

"A"		"B"	
Chromium	48.6	Chromium	50.06
Carbon	8.21	Carbon	8.29
Tungsten	}	Cobalt	}
and		Impurities	
Impurities	43.19		41.65

Resultant

Chromium	48.71
Tungsten	32.31
Carbon	8.23
Cobalt and impurities	10.75

It is also possible to employ the method shown in my copending application, Serial No. 405,540, filed Nov. 7, 1929, which would consist of powdering both the "A" and the "B" metal, mixing in the desired proportions, pressing the resultant mixed powder to the desired shape, and then sintering such pressed shapes to form the final alloy. It is also possible to make the resultant alloy, which is desired, by the first method of casting, and then to break such alloy down into powder, press to shape and sinter to form the finished tool or implement, this, of course, not changing the composition of the final alloy.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the process herein disclosed or the materials employed in carrying out the process, provided the step or steps stated by any of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:

A sintered alloy comprising carbon 8.5% to 9.0%, chromium 55% to 60%, and tungsten 32% to 36%.

ROY T. WIRTH.