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54 Forming components made of hard metal.

A hard metal component such as a wire drawing die is made from a first or inner layer with coarse grained tungsten carbide particles and an outer or second layer with finer grained tungsten carbide particles. Initially the layers have the same content of cobalt. The layers are pressed and then sintered. After sintering the first layer is reduced in cobalt content, but has a much higher wear resistance than a conventional component for the same purpose.

EP 0 194 018 A1

BOART INTERNATIONAL LIMITED 1

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FORMING COMPONENTS MADE OF HARD METAL

## BACKGROUND OF THE INVENTION

This invention relates to components made of hard metal. A hardmetal is usually composed of grains of a hard abrasion resistant
material such as a metal carbide, nitride or the like and a binder

5 metal. The most common form of hardmetal is tungsten carbide with
cobalt as the binder, but frequently tungsten carbide is mixed with
other metal carbides such as titanium carbide and vanadium carbide.

The component in question could be a hard wearing surface such as the surface of a metal rolling roll or it could be used in a tool for 10 cutting or eroding other material such as an insert or button for a rock drill, or the component could provide surface fracture resistance.

#### SUMMARY OF THE INVENTION

According to the invention a method of forming a hard metal component comprises forming two layers of abrasion resistant grains each mixed with a metal binder in substantially the same volumetric proportions, 5 the grains in the first layer being substantially coarser than the grains in the second layer, pressing the layers together and sintering the thus pressed layers to produce the component, whereby the first layer after sintering has a lesser metal binder content than the second layer.

10 The one layer is preferably substantially thinner than the other layer, and the grains in the first layer are about twice the size of the grains in the second layer.

## DESCRIPTION OF AN EMBODIMENT

A wire drawing die was made using a two stage pressing operation.

15 Two centre mandrels of different diameters were used. The diameters

are calculated to give the required layer thicknesses in the sintered product taking into account shrinkage during sintering.

Tungsten carbide mixed with cobalt to an amount of 6% by mass was used. The nominal grain size for the inner layer was 3 to 5 20 micrometres while that of the outerlayer was 1 to 2 micrometres.

Powder of the finer grain size was first poured into the pressing die with a large diameter mandrel at the centre. After pre-pressing at 50% of the final pressing pressure, the first mandrel was removed and replaced with the smaller diameter mandrel. Powder of the coarser

grain size was poured into the annular cavity around the mandrel. The mandrel was removed after final pressing at 150 MPa and the pressing was sintered in a vaccuum at 1400°C for 30 min.

Tests showed that the binder content in the inner, thin layer of the 5 sintered component was reduced by about 50%. The component was ground and polished and then used for wire drawing. The normal production dies at the wire drawing operation in question normally draw between 5 to 5,5 tons of wire before the dies have to be replaced. With the die made as described above 6,5 tons of wire was 10 drawn before the wire no longer fell within the diameter specification.

In a converse situation the layer with the finer grain size could be the thinner one. Thus an anvil of ultra high pressure apparatus could have its tip formed with a layer having a higher binder metal 15 concentration than the body of the anvil. The layer will provide thoughness and protection against surface fracture or cracks.

The essence of the invention is that layered hardmetal products, with differing binder metal contents in the layers, can be made without spalling and cracking by having differential grain sizes but 20 substantially the same initial binder metal content.

## CLAIMS:

1.

A method of forming a hardmetal component comprising forming two layers of abrasion resistant grains each mixed with a metal binder in 5 substantially the same volumetric proportions, the grains in the first layer being substantially coarser than the grains in the second layer, pressing the layers together and sintering the thus pressed layers to produce the component, whereby the first layer after sintering has a lesser metal binder content than the second layer.

10 2.

The method claimed in claim I in which the one layer is substantially thinner than the other layer.

3.

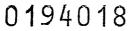
The method claimed in either one of the above claims in which the 15 grains in the first layer are about twice the size of the grains in the second layer.

4.

The method claimed in any one of the above claims in which the grain size in the first layer is between 3 to 5 micrometers and the grain 20 size in the second layer is between 1 to 2 micrometers.

5.

The method claimed in any one of the above claims in which the component is a wire drawing die and the first layer is the thinner layer and is around the die opening.







# **EUROPEAN SEARCH REPORT**

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DOCUMENTS CONSIDERED TO BE RELEVANT  Citation of document with indication, where appropriate, Relevant				0.100.000.000
ategory		h indication, where appropriate, ant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
x	US-A-4 359 335 * Claims 1,2 *	(L.L. GARNER)	1-4	B 22 F 7/06
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