

UNITED STATES PATENT OFFICE

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WELDING METHOD

No Drawing.

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This invention relates generally to a method of forming hard metal facings upon softer metal bodies and to compositions for use in such methods. It is particularly useful wherever a hard wear resisting surface is required, such as for the cutting edges of earth boring drills or other cutting tools, or for other surfaces subjected to severe wear or abrasion.

It is an object of this invention to devise a relatively cheap and convenient method of forming hard metal facings from ordinarily relatively expensive carbide forming elements, such as tungsten.

It is a further object of this invention to devise a method of forming relatively hard metallic carbide facings which will obviate the necessity of employing a carbide forming element, such as tungsten, in relatively pure or uncombined state.

It is a further object of this invention to devise a composition of matter which will facilitate carrying out the method of this invention.

Further objects of the invention will appear from the following description in which I have set forth the preferred embodiment of my invention. It is to be understood that the appended claims are to be accorded a range of equivalents consistent with the state of the prior art.

It has previously been proposed to utilize elements capable of forming relatively hard carbides for forming hard metal facings upon softer machinable or other metal bodies. A process of this character is disclosed in Davies Patent No. 1,613,942, in which process the elements carbon and tungsten are fused by an electric arc upon the surface to be faced. In the Davies process an excess of carbon is supplied so as to provide a de-oxidizing or reducing atmosphere, thus preventing oxidation of the tungsten. The resulting tungsten carbide facing is of extreme hardness, being capable of scratching quartz. In order to render such processes more commercially practical I have utilized an ordinary commercial powdered tungsten in unwrought condition together with carbon, these materials being generally premixed

with a binder to form a homogeneous granular material. Whether the tungsten is utilized in uncombined form as a powdered unwrought material, or as a preformed tungsten carbide, it is comparatively expensive ingredient which materially adds to the cost of forming such facings. In the present invention I utilize tungsten or like material in a cheap readily available form, without detracting from the desired characteristics of the resulting facing.

I have discovered that when forming hard metal carbide facings of elements such as tungsten, by processes such as outlined above, it is possible to utilize natural oxygen containing ores and oxides of the tungsten or other element which is employed. Natural ores or oxides of elements such as tungsten can be secured relatively cheap compared to the refined elements, and I have discovered that the impurities which may be present in such ores do not detrimentally affect the resulting facing. The ore is applied directly to the surface to be faced and is reduced simultaneously with fusing of the same. As a reducing means I can utilize elements such as carbon or silicon, or by providing a reducing atmosphere of gases such as hydrogen. Irrespective of the means employed for effecting reduction of the ore, sufficient carbon is simultaneously supplied so that the resulting facing is a hard carbide of the element or elements supplied thru the ore.

The preferred element which I supply thru the medium of an ore or oxides of the element, is tungsten. The most common ores of tungsten are wolframite (FeMnWO_4) and Hubnerite (MnWO_4). Other natural ores which are not as common are ferritungsite ($\text{Fe}_2\text{O}_3 \cdot \text{WO}_3 \cdot 6\text{H}_2\text{O}$) and ores containing mixtures of tantalite and wolframite. All of these ores contain oxygen in combination with the tungsten, and must be reduced to render the tungsten free to form tungsten carbide.

As a concrete example illustrating the manner in which one of the above ores can be employed in my method, I can secure good results by thoroughly mixing about 9 pounds of powdered wolframite with about two pounds of powdered carbon. This material

is also mixed with a suitable binder such as dextrine, and a certain amount of water or other vaporizable liquid is added. This composition is then baked to dryness and is broken up into small granules, such as will pass a 1/4 inch mesh screen. A layer of this granular material is then spread upon the surface to be faced, and an electrical welding arc is struck between the face of the body and a carbon or other suitable welding electrode. As the arc is gradually progressed over the face of the body in contact with the granular material, this material is fused to form a relatively hard tungsten carbide facing. Generally the facing is applied to iron or steel bodies, and a certain amount of this iron is absorbed by the fused tungsten carbide facing.

The facing resulting from the above method contains from 3 to 10% of carbon and is in excess of 45% tungsten. In this particular method a certain amount of the carbon is utilized in reducing the tungsten ore, and in preventing oxidation of the tungsten, while a certain amount is alloyed with or is dissolved by the tungsten to form a carbide. If a thicker facing or a facing having a harder surface is required, another layer of the composition is applied and fused upon top of the first layer, and similarly a third or any number of layers can be applied. The succeeding layers are of progressively increasing hardness, due to the presence of a progressively lesser percentage of the iron from the body.

In place of utilizing an excess of carbon for effecting reduction of the tungsten ore, I can utilize any equivalent reducing agent, such as an active atmosphere of hydrogen. For example a reducing atmosphere of hydrogen can be utilized by an electrical welding outfit utilizing the atomic hydrogen flame for fusing the composition. When effecting a reduction in this manner, the percentage of carbon employed in the welding composition is correspondingly decreased, since only a relatively small amount of the carbon is then consumed during the welding and reducing steps.

While a tungsten ore is the preferred ingredient for my welding composition and method, my process can also be utilized in connection with ores such as tantalum and molybdenum, or commercially available oxides of these elements, which can be readily reduced with carbon or by the use of a reducing gas such as hydrogen, and which will form carbides harder than machinable steel. Tantalum and molybdenum are elements which will combine with carbon to form relatively hard carbides, and whose ores can be used in my method. Other elements capable of forming hard carbides and whose ores or oxides can be utilized in my method, are vanadium, columbium, (which generally occurs with tantalum), titanium, and uranium.

The hardest and most satisfactory facing has been secured by the use of tungsten, in the manner previously described.

My granular composition of a tungsten ore mixed homogeneously with carbon together with a binder; can be packed in suitable cartons and sold for use in carrying out the method of this invention.

I claim:

1. A process of applying a hard metal facing to a softer metal body comprising placing an oxygen containing compound of an element capable of forming a hard metallic carbide, together with carbon upon the softer metal body, and fusing the element and forming reducing conditions whereby the hard metallic carbide is formed on the softer body.

2. A process of applying a hard metal facing to a softer metal body comprising placing an oxygen containing compound of tungsten together with a reducing agent upon the surface of the body to be faced, and fusing the compound together with the reducing agent upon the body.

3. In a process of applying a hard metal facing to a softer metal body, the step comprising directly reducing and fusing an oxygen containing compound of tungsten, upon the surface being faced, in the presence of carbon, so that the tungsten forms a hard carbide on the surface.

4. In a process of applying a hard metal facing to a softer metal body, the step comprising directly fusing tungsten ore upon the surface being faced while simultaneously supplying carbon, and maintaining the fusion under reducing conditions.

5. In a process of applying a hard metal facing to a softer metal body comprising supplying a mixture of a tungsten ore and carbon to the surface to be faced, and causing said mixture to be fused under reducing conditions.

6. A process of applying a hard metal facing to a softer metal body comprising supplying a tungsten ore and carbon to the surface to be faced, and fusing said materials upon the surface to be faced, the percentage of carbon being sufficient to effect reduction of the ore and to form a hard carbide with the tungsten.

In testimony whereof, I have hereunto set my hand.

HARRY J. MORGAN.