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HARD-METAL COMPOSITION.

No Drawing. Application filed April 26, 1926, Serial No. 104,613, and in Germany May 7, 1925.

My present invention relates to metal compositions and more particularly to compositions comprising hard metal carbides. It is one of the objects of my invention to provide a hard metal composition of very great strength and tenacity which is particularly adaptable for use in connection with wear resisting bodies and cutting tools.

In my prior Patent No. 1,549,615 granted August 11, 1925, I have described and claimed a sintered hard metal composition formed by adding to a powdered tungsten carbide, having a carbon content of 3 to 10%, an auxiliary metal having a lower fusion point than the tungsten carbide. While the metal composition described in the above patent has numerous advantages, I have found it desirable in certain cases, and particularly in the manufacture of cutting tools and utensils, to increase the amount of auxiliary metal in the composition. By increasing the amount of auxiliary metal a product is obtained which has a somewhat lesser degree of hardness than the metal composition described in the patent but a much greater degree of toughness or tenacity. In the manufacture of the new product or material, I have found it advantageous to carburize the powdered form of the basic metal employed, such as tungsten, in the presence of the vapor of a hydrocarbon, such as methane, or the like although the carburization may be effected by mixing the tungsten powder with carbon such as soot or sugar of carbon if desired. The resulting composition, however, differs structurally from that of the prior patent mainly in the amount of auxiliary metal employed.

In making the new product, an auxiliary metal is applied to a powdered hard metal carbide, such as tungsten carbide for example, the auxiliary metal having a sintering temperature below the melting point of the carbide. The carbide is produced by heating the tungsten powder to approximately 1000° C. in the presence of a hydrocarbon vapor, such as methane. When produced in this manner the carbide is a loosely adherent mass which may be easily broken into small pieces by hand without the employment of auxiliary mechanical means. The carbon content of the carbide will usually be substantially the same as described in the prior patent, that is from 3 to 10% of the carbide and may be so measured that tungsten monocarbide together with some free carbon is formed. When the carbide is prepared in this manner it is possible to use a larger volume of the auxiliary metal than was employed in the prior patent. The use of additional auxiliary metal provides a metal composition which possesses a high degree of tenacity and hardness although the hardness of the present composition is slightly less than that described in my prior patent. The increased tenacity of the present composition, however, together with the high degree of hardness which is obtained makes it highly desirable for certain uses as in connection with cutting tools and various forms of utensils.

The auxiliary metals may comprise, as in the main patent, metals which have a sintering temperature lower than the melting point of the carbide, for example, iron, cobalt and nickel, and the quantity of auxiliary metal employed may constitute from 10 to 20% of the alloy, although ordinarily it will not exceed 20% if an extremely high degree of hardnes is required. Cutting tools formed of the above composition are extremely hard and tough, and are capable of cutting not only the hardest known steels but also materials which generally abrade cutting tools.

The auxiliary metal may be in finely powdered form and should be pressed into the pulverized hard metal carbide, and the molded body then heated to a sintering temperature. The pressure employed depends on the shape of the finished product and may vary between 200 and 800 kg. per sq. cm. The resulting material is magnetic, and it is my opinion that the auxiliary metal acts to cement the particles of the carbide, giving strength and toughness to the finished article. As described in my prior patent the temperature at which sintering occurs is affected by the quantity of the auxiliary metal employed but in any case the presence of the auxiliary metal reduces the sintering point of the body far below the fusion point of the carbide. For example, with 5 to 7½% cobalt, the final sintering temperature is about 1400° C. With 10% cobalt, the sintering temperature is 1380° C., and with 15% cobalt, the sintering temperature is 1340° C. The sintering temperature should be maintained more than one hour, preferably an hour and a half, no matter how high the

cobalt content of the composition. If desired, instead of a single auxiliary metal a plurality of such metals may be employed but the amount of such metals should not ordinarily exceed 20% of the entire quantity of the alloy.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. A sintered, hard and tough, metal composition consisting mainly of a hard metal carbide and an auxiliary metal cementing particles of the carbide together, said auxiliary metal having a sintering temperature lower than the melting point of the carbide and comprising more than 10% of the resulting combination.

2. A sintered, hard and tough, composition consisting substantially of tungsten-carbide and cobalt, the cobalt forming more than 10% but not more than 20% of the total content of the composition.

3. A sintered, hard and tough, composition consisting, except for minor impurities, of tungsten, carbon and cobalt, the carbon content varying from 2.4 to 9.0%, the cobalt content being more than 10% but not more than 20% of the total content of the composition and tungsten the remainder.

4. A sintered, hard and tough, metal composition consisting mainly of a hard metal carbide but containing an auxiliary metal, said auxiliary metal forming more than 10% but not more than 20% of the total content of the composition, said composition having a sintering temperature lower than the melting point of the carbide.

5. A sintered, hard and tough, metal composition consisting largely of a hard metal carbide, and containing an appreciable amount of cobalt, the cobalt forming more than 10% of the total content of the metal composition.

6. A sintered cutting tool, said tool consisting mainly of a hard metal carbide, and containing an appreciable amount of auxiliary metal having a sintering temperature lower than the melting point of the carbide, said auxiliary metal forming more than 10% of the total content of the cutting tool.

7. A sintered cutting tool consisting largely of a hard metal carbide, and containing an appreciable amount of cobalt, the cobalt forming more than 10% of the total content of the cutting tool.

8. A sintered cutting tool consisting largely of a carbide of tungsten and containing an appreciable amount of a metal having a lower melting point that the carbide, said metal forming more than 10% of the total content of the cutting tool.

9. A sintered, hard and tough, metal composition consisting mainly of tungsten carbide and containing more than 10% of cobalt.

10. A sintered, hard and tough, metal composition consisting mainly of a carbide of metal of the sixth group and a quantity of metal of the iron group, the metal of the iron group forming more than 10% and less than 20% of the composition.

11. A sintered, hard and tough, metal composition consisting largely of tungsten and containing cobalt and carbon, the amount of cobalt being more than 10% and less than 20% of the total content of the metal composition.

In witness whereof, I have hereunto set my hand this 12th day of April, 1926.

KARL SCHRÖTER.