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UNITED STATES PATENT OFFICE.

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HARD-METAL ALLOY AND THE PROCESS OF MAKING SAME

No Drawing.

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REISSUED

To all whom it may concern:

Be it known that I, KARL SCHRÖTER, a citizen of the German Realm, residing at Lichtenberg, near Berlin, Germany, have invented certain new and useful Improvements in Hard-Metal Alloys and the Processes of Making Same, of which the following is a specification.

My invention relates to hard metal alloys.

More particularly, it relates to alloyed tungstic carbide which alloy is suitable for making working implements of various sorts and which is particularly suitable for making hones.

The alloy of my invention differs from known alloys primarily by consisting of a tungstic carbide with a carbon content of from 4 to 10 per cent, in combination with an auxiliary metal of a considerably lower melting point as, for instance, iron, cobalt or nickel, in quantities up to a maximum of 10 per cent. A tungstic metal thus constitutes the predominating element amounting to at least 80 per cent of the total content of the alloy. The new alloy is not inferior in respect to hardness to the known tungstic carbide alloys and is quite considerably superior to these for strength.

To make the new alloys, it is advantageous to press into a body of pulverized tungstic carbide containing from 3 to 10 per cent carbon, together with an auxiliary metal in a finely divided state and in a quantity within the limits specified, and to heat this body to sintering temperature. The effect of the auxiliary metal is to reduce the sintering point of the body to such an extent that it occurs at temperatures which lie in the neighborhood of 1000 degrees below the melting point of the pure carbide. The foregoing method is considerably cheaper, easier and simpler than the methods used heretofore in the prior methods and a temperature of about 2500 degrees must be obtained.

Another object of my invention is that inasmuch as the body may be pressed and sintered in a manner well known, it is possible to make the body into any desired form such as is obtained only with great difficulty when other processes are used.

In making the new alloy, pulverized tungstic carbide can be used as the main material which can be produced by carburizing tungstic powder from the gas phase, or by mix-

ing the tungstic powder with carbon. The carbon may be of soot, sugar of carbon, graphite and the like. A carbon content of 7 per cent has proved especially favorable, but it can be varied from 3 to 10 per cent.

A metal which can be reduced by hydrogen and which has a considerably lower melting point than the tungstic carbide is suitable for use as the auxiliary metal, for example, iron, cobalt or nickel. These metals may be in a finely divided form. The temperature at which the sintering occurs is affected by the quantity of the admixed auxiliary metal, which can be made as high as 10 per cent of the alloy. For instance, an admixture of 5 per cent cobalt has proved particularly favorable in which case a very hard and exceedingly compact product is produced. Instead of using a single auxiliary metal as those named in the foregoing, two or several of the auxiliary metals may be added to the tungstic powder in which case the auxiliary metals can be taken in any suitable ratio to each other, but they must not, all told, make up more than 10 per cent of the total quantity of the alloy. The sintering of the bodies, which bodies are formed for instance by hydraulic pressure, can be effected by heating them in a protective atmosphere such as an atmosphere of hydrogen, nitrogen, argon, illuminating gas, carbonic oxide, or an admixture of such gases, or the sintering can be effected by embedding the bodies in carbon, graphite and the like. Suitable sintering temperature may be found between 1500 and 1600 degrees C.

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

1. A hard metal alloy comprising a carbide of tungsten, the carbon content of which ranges from 3 to 10% of the tungsten, said alloy having, in addition, a metal of a considerably lower melting point than the carbide, said metal forming not more than 10% of the tungsten content.

2. A hard metal alloy comprising a carbide of tungsten, the carbon content of which ranges from 3 to 10% of the tungsten, said alloy having a metal of the iron group, the latter forming not more than 10% of the tungsten content.

3. A hard metal alloy comprising a carbide of tungsten, the carbon content of which

ranges from 3 to 10% of the tungsten, said alloy having iron, the latter forming not more than 10% of the tungsten content.

4. The method of making an alloy of a carbide of tungsten and a metal which consists in bringing together a pulverized tungsten carbide and a quantity of finely divided metal, mixing said materials and pressing them into forms and heating the forms to sintering temperature.

5. The method of making an alloy of a carbide of tungsten and a metal which consists in bringing together a pulverized tungsten carbide, said carbide having a carbon content within the ranges of from 3 to 10%,

and a quantity of finely divided metal, said metal not exceeding 10% of the tungsten constituent, mixing said materials and pressing them into forms and heating the forms to sintering temperature.

6. A hard metal alloy consisting of a mixture of tungsten carbide and a metal with a melting point considerably lower than that of the carbide, the proportions of the tungsten carbon and of the metal being respectively not more than 80% of tungsten, 10% of carbon and 10% of the metal.

In witness whereof, I have hereunto set my hand this 8th day of October, 1923.

KARL SCHRÖTER.