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UNITED STATES PATENT OFFICE.

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ALLOY AND PROCESS OF MAKING THE SAME.

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To all whom it may concern:

Be it known that I, FREDERICK T. McCURDY, a citizen of the United States, residing at Kokomo, in the county of Howard and State of Indiana, have invented certain new and useful Improvements in Alloys and Processes of Making the Same, of which the following is a specification.

The presence in metal alloys of substantial proportions of cobalt and one or more metals of the chromium group (chromium, tungsten, molybdenum and uranium) is known to impart remarkable properties to such alloys. In general, the alloys are highly resistant to oxidation and other corroding influences, are hard, strong and elastic, and capable of taking a fine cutting edge, and when worked up into cutting tools, for example lathe tools, preserve their hardness and edge at remarkably high temperatures, thus permitting the use of very high cutting speeds. Alloys of the type referred to are disclosed, for example, in the patents to Elwood Haynes, No. 873,745, December 17, 1907, No. 1,057,423, April 1, 1913, No. 1,057,828, April 1, 1913 and No. 1,150,113, August 17, 1915.

I have found that the properties of alloys containing cobalt and one or more chromium group metals may be much improved by the addition of tantalum. My new alloys may be produced by incorporating substantially pure tantalum into a molten bath containing the other metals, or by adding the tantalum previously alloyed with other metals which exercise no prejudicial effect on the final product. I prefer, however, to apply the tantalum as oxid, either the naturally-occurring iron and manganese tantalities or the artificial pent-oxid being employed. The tantalum material may be added either before or after the fusion of the other constituents of the alloy.

Even when no reduced tantalum is used, and only oxid is added, the resulting product shows the presence of tantalum, presumably as alloyed metal. If tantalum oxid is used, I prefer to have present in the molten bath with which the oxid is brought into contact, one or both the readily oxidizable elements of the carbon group (carbon and silicon) as these appear to assist in the reduction of the tantalum oxid and the incorporation of the metal into the alloy. If carbon and silicon are desired in the final product, due allowance must of course be made for the quantities oxidized and removed by the tantalum oxid.

While I am unable to describe the mechanism of the action of the tantalum material, the effect on the alloy is striking. The metal is denser and finer grained in its micro-structure, while the strength and permissible cutting speed are frequently increased by a third of their value in an exactly similar alloy without tantalum addition.

In a specific instance where the beneficial action of tantalum was marked, two similar charges were melted, tantalum oxid equivalent to 2% of the weight of metals present being added to one charge. Each of the resulting alloys contained approximately 50% cobalt, 25% chromium and 15% tungsten. The alloy produced from the charge without tantalum addition contained 0.64% silicon and 2.22% carbon while the charge which included tantalum oxid produced a metal in which silicon was reduced to 0.26% and carbon to 2.04%, tantalum being present in the metal in the amount of 1.08%.

I have obtained good results by using tantalum oxid in amounts up to 10% of the charge. If the tantalum is added as reduced metal or alloy, it may be used in amounts varying from fractional percentages to 5%.

With respect to the constituents other than tantalum in my finished alloys, a wide range of proportions is permissible. Preferably cobalt and the chromium metal should each be present in an amount not less than 10% of the total alloy. The compositions disclosed in the patent to Haynes, No. 1,057,423 referred to above, give alloys having highly desirable properties when tantalum is added. Iron and nickel may be added as desired to prevent excessive hardness and promote forgeability, if desired, as disclosed in Haynes No. 1,150,113.

I claim:

1. A metal alloy comprising cobalt, a metal of the chromium group, and tantalum, the cobalt and metal of the chromium group each being present in the proportion of at least 10% and the tantalum being not substantially in excess of 5%.

2. A metal alloy comprising cobalt, chromium and tantalum, the cobalt and chromium each being present in the proportion of at least 10% and the tantalum being not substantially in excess of 5%.

3. A metal alloy comprising cobalt, chromium and another metal of the chromium group, and tantalum, the cobalt and chromium each being present in the proportion of at least 10% and the tantalum being not substantially in excess of 5%.

4. The process which comprises bringing a molten bath containing cobalt, a metal of the chromium group and a reducing agent, into contact with tantalum oxid.

5. The process which comprises bringing a molten bath containing cobalt, a metal of the chromium group and an element of the carbon group, into contact with tantalum oxid.

6. The process which comprises bringing a molten bath containing cobalt, chromium, another metal of the chromium group, and a reducing agent, into contact with tantalum oxid.

In testimony whereof, I affix my signature.

FREDERICK T. McCURDY.