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METHOD FOR HARDENING COBALT STEEL

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The present invention relates to a method for hardening alloy steel and more particularly to a method for hardening cobalt steel containing for example about 36% cobalt, 8% molybdenum, 5.5% chromium, 1% carbon and the remainder iron. A composition of this character is disclosed in Honda Patent #1,338,134. Ordinarily, cobalt steel such as disclosed in the Honda patent may be hardened by heating the steel to a temperature of about 950° C. and then quenching in oil. This treatment provides a steel which has a hardness of about 62 on the Rockwell C scale.

It is an object of the present invention to increase the hardness of cobalt steel by means of an additional heat treatment and to provide thereby a steel suitable for use as a high speed metal cutting tool.

In carrying out the present invention the ingredients comprising the tool composition are melted preferably in a high frequency furnace and cast into bars of convenient size. The cast bars are then given a primary hardness of about 62 on the Rockwell C scale by heating to about 950° C. and quenching in oil.

In accordance with the present invention this primary hardness is increased by aging the steel in a non-reducing atmosphere such as air or nitrogen at temperatures varying from about 450° C. to 550° C. The temperature of the steel is raised gradually to the aging temperature and maintained at that point for about 1 to about 10 hours, after which the steel is cooled in air.

The aging process increases the hardness of the steel to about 70.5 on the Rockwell C scale. The resulting product is harder and tougher than high speed steel heretofore produced and has been found to be particularly suitable for use in machining copper, mica insulated commutators, phenol condensation products and the like.

The quantities of materials employed in manufacturing the steel may vary within the limits indicated in the Honda patent. Generally, the alloy will consist mainly of iron and cobalt but will contain molybdenum, chromium and carbon in appreciable but minor quantities, the molybdenum usually being in excess of the chromium.

Although I have indicated only one method for obtaining the primary hardness in the present alloy, various other well known methods may be employed if desired. For example, the primary hardness may be obtained by normalizing the cast bars at about 1150° C. and then quenching at 950° C. or the cast bars may be annealed from 750° C. and then oil quenched from 950° C., or the cast bars may be normalized at 1150° C. annealed at 750° C. and then oil quenched from 950° C. Although any one of these methods will be found to produce a suitable degree of primary hardness, I have found that the maximum hardness, in connection with the present invention, may be obtained when the cast bars are simply heated to about 950° C. and quenched in oil. A relatively high primary hardness is obtained by this treatment and a high secondary hardness is obtained when the steel is thereafter aged at about 450–550° C. This cycle of primary hardening, followed by the specified age-hardening, also may be applied to the forged steel of like compositions. A hardness of about 70 on the Rockwell C scale is obtained for the forged steel.

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

1. The method of hardening steel consisting substantially of 5% to 60% cobalt, 1% to 10% molybdenum with the remainder carbon steel containing from about .5% to 2% carbon which comprises quenching the steel from a temperature of about 950° C. and aging it at about 450° C. to 550° C.

2. The method of increasing the hardness of steel consisting substantially of 5% to 60% cobalt, 1% to 10% molybdenum, 0.5% to 10% chromium and the remainder carbon steel containing about .5% to 2% carbon which comprises melting the ingredients comprising the steel, heating the steel to a temperature of about 950° C. quenching the steel and aging it at about 450° C. to 550° C.

3. The method of increasing the hardness of steel consisting substantially of about 36% by weight of cobalt about 8% molybdenum, about 5.5% chromium and about 1% carbon with the remainder iron, which comprises quenching the steel from about 950° C. and aging the steel at a temperature within the range of 450 to 550° C.

4. The method of increasing the hardness of steel containing 5 to 60% cobalt, 1 to 10% molybdenum, 0.5 to 10% chromium, the remainder consisting substantially of carbon steel containing 0.5 to 2% carbon which comprises quenching the steel from about 950° C. and aging the steel at a temperature within the range of about 450 to 550° C.

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