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HIGH SPEED STEEL

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1 Claim. (Cl. 75—1)

This invention relates to high speed steels; and it comprises a high speed tool steel containing a small amount of titanium and characterized by enhanced hardness at high temperatures and high resistance to frictional wear at such temperatures, said steel having a high elastic limit and in its best embodiment containing iron, together with tungsten 15 to 18 per cent, chromium 2.5 to 5 per cent, titanium 1 to 2.5 per cent and carbon 0.1 to 0.8 per cent, said steel often advantageously containing, in addition to the other components, small amounts of metals selected from the class consisting of beryllium, cobalt and vanadium; all as more fully hereinafter set forth and as claimed.

High speed steels, as the term is used to-day, are alloys adapted for making cutting tools, and particularly lathe tools, remaining hard and preserving edge at high temperatures; alloy steel tools retaining their cutting edge up to a red heat or higher, thereby permitting rapid cutting with a lathe or other tools. Good alloy steel tools are not rapidly worn down or permanently deformed by use on hot metal. There are many of these steels known and in use and they have produced a marked economy in the metal working industries by permitting speeding up of lathes and the like. A good high speed tool steel alloy is, however, somewhat difficult to make; it is difficult to produce alloys with the necessary high resistance to temperature and to frictional wear and having a high elastic limit. The quality of the tool is, in a large measure, incident to the particular way in which it is made; the behavior of these alloys being somewhat erratic. The requirements for an alloy for this use have, naturally, become more rigid in the last few years. Chromium was formerly the essential hardening metal in these alloys, but substantial amounts of tungsten are often components of the newer alloys. Most of these steels, however, contain some chromium and vanadium in some proportion, with, usually, some carbon.

I have found that the usual high speed tool steels are improved by the presence of some titanium; not only are their high temperature resistance and resistance to wear enhanced, but the behavior of a given alloy is made less erratic; it is easier to produce good tools invariably.

The best of these improved alloys which I have found contains iron, tungsten, chromium and carbon and, also, some titanium. By the use of titanium, I obtain the stated enhancement of the stated properties and the metal is highly homogeneous; it is free from included gases, oxids, nitrids and the like. The elastic limits of these metals are high and wear under friction is low. Tools made of the alloy hold their edge well on a lathe, even under extremely rapid operating conditions with the work at temperatures around a red heat.

The best composition for the stated alloy, so far as my present knowledge extends, is a composition as follows:—

Tungsten	15	to 18	per cent
Chromium	2.5	to 5	per cent
Titanium	1	to 2.5	per cent
Carbon	0.1	to 0.8	per cent
Iron	Remainder		

Vanadium is often used in high speed steels and it may be employed with advantage in the present composition. It may, however, be dispensed with. The same is true as regards the addition of some amounts of beryllium or cobalt. These metals are advantageous and one or more of them may be added to the steel.

There is a little carbon in the composition stated and this carbon, in the proportions used, acts as a stabilizer and grain refiner and it aids in heat treating.

Alloys under the present invention are best made by producing a melt of a standard high speed tool steel alloy and adding the calculated amount of ferro-titanium. For example, a melt may be made of the composition stated with a little less iron and an amount of ferro-titanium which will bring the iron content to the stated figure and add the stated amount of titanium. The alloy is manufactured into tools in a manner usual in the art.

What I claim is:—

A stabilized high speed tool steel alloy of fine grain and having high elastic limits and high resistance to frictional wear under high temperature working, said alloy containing iron alloyed with 15 to 18 parts tungsten, 2.5 to 5 parts chromium, 1 to 2.5 parts titanium and 0.1 to 0.8 parts carbon in 100 parts of the alloy, the remainder being principally iron.

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