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UNITED STATES PATENT OFFICE.

RICHARD WALTER, OF DUSSELDORF, GERMANY.

ALLOY.

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To all whom it may concern:

Be it known that I, RICHARD WALTER, a citizen of the German Empire, residing at Dusseldorf, Germany, have invented certain new and useful Improvements in Alloys (for which I have filed application in Germany, March 24, 1920), of which the following is a specification.

The present invention has reference to improvements in the treatment of metals and more particularly of metals of the iron and chromium groups and their alloys, and it relates more specifically to a method for generally improving the product of such treatment by incorporating therein in the course of the treatment relatively minute amounts of boron, as will now be described in detail.

Many attempts have been made to improve iron and steel and their alloys by adding boron thereto, but the results so far were not encouraging for the reason that the amount of boron used, generally from 0.2–2%, is altogether too high and renders the product too hard and brittle; and of late the experiments with boron in this connection have practically been abandoned. Now, contrary to this general assumption I have found by extended experimentation that boron, if used in the proper proportions and under the proper conditions forms an ideal admixture to any one of the metals of the iron and chromium groups, or alloys thereof in any chosen mixing proportions. I have found that even such a minute amount as 0.001% boron completely revolutionizes the structure of iron-carbon alloys, especially as concerns the fineness of the texture. An addition of from 0.005–0.008% of boron to steel, without any other additions, results in the production of highest class steel. The percentage of boron may be raised to a maximum of about 0.09 or 0.1%, care being taken that the amount of the carbon content be properly chosen. If a higher percentage than indicated of boron be used the product will turn out very brittle and useless for most purposes.

If a minimum of 0.007 up to a maximum of 0.01% of boron is added to steel, it will produce a self-hardening steel.

The boron particles thus added to the charge form, as it were, the nuclei around which the crystallization of the melt on cooling takes place.

I have found that even the tendency which a high content of phosphorus in the making of steel shows of causing a rather coarse crystallization, is effectively neutralized by the boron addition, so that for instance a steel casting containing about 0.3% of carbon and 0.2% of phosphorus, and as little as 0.002% of boron will show a texture of such fine grain as cannot be obtained in phosphorus-free steel even by the most careful annealing.

Boron-steel castings of this character need no further annealing and can readily be used in place of forged steel.

This fine-grain structure, obviously, considerably enhances the mechanical strength of the material, especially after proper tempering. Thus, untempered rolled steel, containing 0.4% carbon, should have a tensile strength of 52 kilograms, after tempering it will show a strength of 65 kilograms per square millimeter. If now boron to the amount of not over 0.002% is added to the steel, the tensile strength of the latter in the untempered state will be raised to 65 kilograms, and after tempering to 136 kilograms per square millimeter. The structure of such steel is of sorbitic character.

Similar effects result in the case of alloyed steels, such as for instance nickel-, tungsten-, chrome-nickel-, and molybdenum-steel, which are especially adapted for the manufacture of the highest class of cutting tools.

Cast iron likewise shows the revolutionary effect of the boron on the structure of the final product. The graphite, instead of separating out in long laminæ will be found to disincorporate in exceedingly finely distributed globules or grains, which impart to the mass an extraordinary density and high tensile strength.

What I claim is:—

1. A carbon bearing alloy with iron as the predominant element, having incorporated therein a boron content within the limits of 0.001 and 0.1%.

2. A carbon bearing alloy of iron and a metal of the chromium group with boron, the proportional amount of which latter is not lower than 0.001 and not higher than 0.1% of the total.

In testimony whereof I affix my signature.

RICHARD WALTER.