

## UNITED STATES PATENT OFFICE

2,486,282

HEAT-TREATMENT FOR HIGH CARBON  
HIGH CHROMIUM STEEL

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2 Claims. (Cl. 148—21.5)

1

This invention relates to high carbon high chromium steels and more particularly to thermal treatments for such steels.

The use of high carbon high chromium steels of the class containing from .5 to 1.25 per cent carbon and 10 to 16 per cent chromium, manganese in effective amounts but not over 1.10 per cent, .25 per cent maximum nickel, normal amounts of phosphorus, sulphur and silicon and the balance substantially iron except for residual amounts of other elements, has heretofore been restricted because of their extreme brittleness at room temperature. A typical analysis of a steel within this class is about 1 per cent carbon, 14 per cent chromium, and .80 per cent manganese. Such a steel is generally considered martensitic.

By treating such steels as the foregoing in accordance with the teachings of our invention, as hereinafter described, it becomes possible to cold process them after being hot rolled or forged. Ordinarily such steels cannot be further processed to any great extent by cold rolling or other deforming at or near room temperature because of their extreme brittleness. In part, this brittleness, which results in fracturing of the steel upon very slight deformations at or near room temperature, is the result of excessively large, usually angular, carbides formed during the solidification and cooling of the steel. These carbides may increase in size during the hot working heating operations.

In accordance with the teachings of our invention, such steels can be annealed and rendered suitable for cold deformation in the following manner. Articles composed of steel of the specified composition are heated preferably to between 50° and 75° F. below the melting range of the steel, or to from 2100° and 2250° F. and held at such temperature between fifteen minutes and four hours. Following this, the steel is cooled as rapidly as possible to a temperature within the range of 1250° to 1450° F. and held within this range between four and twenty-four hours, after which it is cooled in any manner to room temperature.

After such treatment, the steel is sufficiently soft and ductile to withstand large cold deformations.

2

While we have described one specific embodiment of our invention, it will be understood that this embodiment is merely for the purpose of illustration and description and that various other forms may be devised within the scope of our invention, as defined in the appended claims.

We claim:

1. A method of producing cold-deformable high chromium alloy steel containing between .5 and 1.25 per cent carbon, 10 to 16 per cent chromium, manganese in effective amounts up to 1.10 per cent; not over .25 per cent nickel and balance substantially iron comprising heating said alloy steel to a temperature between 2100° and 2250° F., holding at said temperature for between fifteen minutes and four hours, rapidly cooling from such temperature to within the range of 1250° to 1450° F. and holding in such range for a time between four and twenty-four hours.
2. A method of producing cold-deformable high chromium alloy steel containing between .5 and 1.25 per cent carbon, 10 to 16 per cent chromium, manganese in effective amounts up to 1.10 per cent, not over .25 per cent nickel and balance substantially iron comprising heating said alloy steel to a temperature within 50° to 75° F. below the melting range of the steel, holding at said temperature for between fifteen minutes and four hours, rapidly cooling from such temperature to within the range of 1250° to 1450° F. and holding in such range for a time between four and twenty-four hours.

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**Certificate of Correction**

Patent No. 2,486,282

October 25, 1949

CARROLL G. HOFFMAN ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 2, line 10, for "6 per cent" read *16 per cent*;  
and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of February, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,  
*Assistant Commissioner of Patents.*