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METHOD OF TREATING STEEL

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This invention relates to methods of treating steel and particularly to a method of treating steel to prevent cold checks, (edge cracking) and improve hot workability in high alloy steels.

One of the problems in the rolling and working of relatively high alloy steels such as the stainless steels is that of cold checking. For example, austenitic stainless steels are frequently cold checked particularly during the rolling of the last quarter or more of a coil due to cooling of the steel below the most plastic temperature. This defect of cold checking is quite serious and often results in the discarding of a substantial portion of a coil, particularly at the end of a coil.

We have discovered that if a small amount of a fluorine containing organic compound, for example, polytetrafluroethylene, is added to the molten steel prior to solidification, cold checking will be eliminated and the hot workability of the steel will be materially improved. Similar results may be attained with other high alloy steels where the problem of hot workability and cold checking are of significance.

The practice of our invention may perhaps best be understood by reference to the following examples.

A stainless steel of the austenitic type having a nominal analysis as follows:

Carbon	0.1
Manganese	0.8
Silicon	0.6
Phosphorus	0.025
Sulphur	0.020
Chromium	18.1
Nickel	8.3

was cast and rolled into strip in the usual fashion. The last quarter of the coil in a 48" wide strip cold checked as much as 2"in each side. An ingot from the same heat to which 2 ounces per ton of polytetrafluroethylene was added, in each of two successive additions in the ladle, followed by four ounces of polytetrafluroethylene per ton during teeming in the mold was rolled in precisely the same manner and no cold checking whatever was experienced. This shows definitely that hot workability was improved.

Similar results have been attained with stainless steels of other high alloy compositions as well as with tool steel compositions and other highly alloyed steels.

X-ray studies were made, both before and after working, of high alloy steels from the same heat as the example, one ingot treated with polytetrafluroethylene as described in the above example and the other untreated. These X-ray micrographs show that the steels which have been treated according to the invention will be healed of voids and rifts by working, whereas the untreated steel will continue to have these defective areas throughout the history of the working process.

A comparison of these radiographs show that the voids and rifts in the untreated steel continued after working whereas in the treated steel the voids and rifts either healed during the working operations or were not present.

We have found that the present practice will accomplish the substantial elimination of cold checking and

will materially improve hot workability in alloy steels.

Preferably the practice of our invention consists in adding about one to two ounces per ton of polytetrafluroethylene in each of two spaced additions in the ladle followed by another addition of about two to six ounces per ton in the mold during or immediately following teeming.

The polytetrafluroethylene may be added by the method and apparatus described in our application, Serial No. 104,197, filed May 5, 1961 now Patent 3,079,250, issued February 26, 1963.

While we have disclosed certain preferred practices of our invention it will be understood that the invention may be otherwise embodied and practiced within the scope of the following claims.

We claim:

1. The method of eliminating cold checking and improving hot workability in alloy steels comprising the steps of adding about two ounces to four ounces of polytetrafluroethylene per ton of steel to the alloy steel to be treated in the ladle, adding to the same steel about two to six ounces of polytetrafluroethylene per ton of steel in the mold, solidifying the molten mass and working the steel.

2. The method of eliminating cold checking and improving hot workability in alloy steels comprising the steps of adding about one ounce to two ounces of polytetrafluroethylene per ton of steel in each of two spaced additions to the alloy steel to be treated in the ladle, adding to the same steel about two to six ounces of polytetrafluroethylene per ton of steel during teeming in the mold, solidifying the molten mass and working the steel.

3. The method of eliminating cold checking and improving hot workability in alloy steels comprising the steps of adding about two ounces of polytetrafluroethylene per ton of steel in each of two spaced additions to the alloy steel to be treated in the ladle, adding to the same steel about four ounces of polytetrafluroethylene per ton of steel during teeming in the mold, solidifying the molten mass and working the steel.

4. The method of eliminating cold checking and improving hot workability in austenitic stainless steels comprising the steps of adding about two ounces to four ounces of polytetrafluroethylene per tone of steel to the alloy steel to be treated in the ladle, adding to the same steel about two to six ounces of polytetrafluroethylene per ton of steel in the mold, solidifying the molten mass and working the steel.

5. The method of eliminating cold checking and improving hot workability in austenitic stainless steel comprising the steps of adding about one ounce to two ounces of polytetrafluroethylene per ton of steel in each of two spaced additions to the alloy steel to be treated in the ladle, adding to the same steel about two to six ounces of polytetrafluroethylene per ton of steel during teeming in the mold, solidifying the molten mass and working the steel.

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