Patented May 2, 1933

1,907,385

UNITED STATES PATENT OFFICE

JOHN HOWE HALL AND JOSEPH S. COMERFORD, OF HIGH BRIDGE, NEW JERSEY, ASSIGNORS TO TAYLOR-WHARTON IRON AND STEEL COMPANY, OF HIGH BRIDGE, NEW JERSEY, A CORPORATION OF NEW JERSEY

AIR TOUGHENED ALLOY STEEL

No Drawing. Original application filed May 16, 1927, Serial No. 191,926. Divided and this application filed September 4, 1929. Serial No. 390,422.

Our invention relates to the production and treatment of iron or steel alloys and more particularly to the production and treatment of manganese steel articles in cast, forged, rolled, wrought or drawn state, the instant application being a division of application Ser. No. 191,926, filed May 16, 1927- (now Patent No. 1,732,202); the principal object being to so treat the improved alloy of our invention that articles made therefrom will not require water quenching or other usual toughening treatment incidental to austenitic manganese steel, but may be toughened in the air.

In extended experimentation, having for its ultimate object the production of sound manganese steel articles qualified for service for which ordinary manganese steel is not suited, and in sizes much greater than heretofore has been attainable with known compositions and methods, we have discovered a steel alloy and method of treating it which possesses to a remarkable degree the useful properties of austenitic manganese steel, fulfills the necessary requirements, and moreover readily responds to air toughening.

The air toughened steel of our invention may be identified as

Steel A

		Preferred
Carbon	.30 to .85	.60 to .80
Nickel	1. to 5.	3.
Manganese	10. to 15.	13.
Silicon	.15 to .50	.40

Steel B

		Preferred
Carbon	.30 to .85	.60 to .80
Nickel	1. to 5.	3.
Chrome	1. to 8.	4.
Manganese	10. to 15.	13.
Silicon	.15 to .50	.40

The physical properties of steel A are similar to those of ordinary manganese steel, but the strength in both tension and compression is considerably lower and if the carbon is decreased the strength falls off quite rapidly. In the case of the preferred composition of steel B the physical properties obtained on tensile, compression and bending tests approach quite closely to those of ordinary manganese steel, but if either the chrome or the carbon or both are decreased the strength falls off quite rapidly.

Hence, we have found it essential for our purpose to sharply control the carbon and chrome content, either or both as the case may be. Accordingly, in the one case, we use varying amounts of low carbon ferro-manganese, and in the other case low carbon ferro-chrome. The use of ordinary 80% ferro-manganese to obtain all of the manganese required would result in too much carbon, which as indicated is detrimental. So also, there would be an untoward result in the use of straight ferro-chrome.

We have successfully manufactured steel, of the compositions stated, in the electric furnace, using as additions metallic nickel, ferro-chrome—of which part is low carbon ferro-chrome — and ferro-manganese — of which part must be low carbon ferro-manganese.

The toughening of these steels is accomplished by heating or soaking and then cooling them in the air. They then possess the toughness of ordinary manganese steel and the property of hardening under cold work also characteristic of that steel. The soaking heat may range from 800° C. to 1150° C. according to relative metal section, and for such time as is necessary properly to condition the article for quenching.

Having described our invention, we claim:

1. The method herein described, which consists in forming an article from a steel alloy composition containing ten to fifteen per cent manganese, an effective amount up to five per cent metallic nickel, an effecting amount up to eight per cent chromium, about decimal thirty to decimal eighty-five per cent carbon, and about decimal fifty per cent silicon, soaking the article at a temperature ranging from about 800° C. to about 1150° C., according to mass and relative metal section, to condition it for quenching, and quenching in the air.

2. The method which consists in forming, a steel alloy composition relatively low in carbon and containing ten to fifteen per

cent manganese, from a melt including an effective amount up to five per cent metallic nickel and ferromanganese quantitatively sufficient to produce the range stated and having a low order of carbon in order sharply to control the carbon content of the alloy, forming a shaped article from said composition, heating the article to quenching temperature, and quenching in air.

In testimony whereof we affix our signatures.

JOHN HOWE HALL.
JOSEPH S. COMERFORD.