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AIR-TOUGHENED ALLOY STEEL

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Our invention relates to the production and treatment of iron or steel alloys and more particularly to the production and treatment of manganese steel.

In extended experimentation having for its ultimate object the production of sound manganese steel in cast, forged or rolled form, qualified for service for which ordinary manganese steel is not suited, and in sizes much greater than heretofore attainable with known compositions and methods, we have discovered a steel alloy which when properly made and treated possesses to a remarkable degree the useful properties of austenitic manganese steels, 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 steels, 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 may be 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 period of term as is necessary properly to condition the article for quenching.

Having described our invention, we claim—

1. Manganese steel responsive to air toughening, containing less than one per cent of carbon, an effective amount up to five per cent of nickel, less than decimal fifty per cent silicon, and ten to fifteen per cent of manganese.

2. Manganese steel responsive to air toughening, containing less than one per cent of carbon, about four per cent of nickel, not over decimal fifty per cent silicon, and ten to fifteen per cent of manganese.

3. Manganese steel responsive to air toughening, containing decimal thirty to decimal eighty-five per cent of carbon, one to four per cent of nickel, less than decimal fifty per cent silicon, an effective amount up to eight per cent of chrome, and ten to fifteen per cent of manganese.

4. Manganese steel responsive to air toughening, containing decimal thirty to decimal

eighty-five per cent carbon, an effective amount up to four per cent nickel, about decimal forty per cent silicon, and ten to fifteen per cent manganese.

In testimony whereof we affix our signatures.

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