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STEEL

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This invention relates to an improved steel and particularly to an improved high manganese pearlitic steel.

The steel contemplated in this invention is found to have various superior qualities and properties, and may be used in many applications where its properties are found desirable, but it is found that it has particular usefulness when applied to the manufacture of railroad car wheels.

One of the advantages realized in this improved steel is that it has greater hardness penetration as affected by the hardening process, such as by quenching with water, oil, or other suitable mediums. This quality makes for a greater depth of hardened surface on articles made from this improved steel and consequently is very advantageous when applied to car wheels in that it is best to provide a hard wearing surface for a greater depth inwardly of the outer periphery and thereby increase the life of the wheel in service. It is to be understood, however, that wherever greater hardness penetration makes for improvement that this steel will be applicable with more improved results.

Another advantage realized in this improved steel is that it is more resistant to subsequent tempering or drawing temperatures, or, in other words, is a steel, the hardness of which is less affected than other parlitic steels heretofore known when they are subsequently heat treated in a manner to temper them or reduce their brittleness. This feature makes for improvement particularly in the case of car wheels in that the hardness of the wearing surfaces is little affected when the articles are tempered by subsequent heat treatment and also particularly in that the heating of the wheel rim in service, due to brake application, which frequently reaches 800 or 900° F., does not affect to a great extent the hardness of the metal whereby the wheel is more resistant to the wear and tear of the track and brake shoes at these high temperatures.

In practice it is well known that car wheels disintegrate and that particles of the wheel tread crack and splinter away from the main body of the wheel due to the unusually severe conditions to which wheels are subjected in service. In many well known types of wheels this is partially attributable to the softening of the wheel surface under the heat created by friction between the parts, and particularly the brake shoe on the wheel surface. Where this occurs the yield point of the steel materially decreases and therefore the steel is more subject to fatigue cracks. In the present steel, even though the heat be present, it has very little softening effect on the metal and consequently the disadvantages heretofore realized in this particular are to a large extent eliminated.

The present advantages are found to exist in a steel known in the art as a high manganese pearlitic steel in which .50% to 2.00% of copper is present. It is to be understood that the high manganese pearlitic steel may vary within certain limits as to its constituent parts, the main requirement being that it contain sufficient manganese to classify it as a high manganese steel and have the other constituents so selected and proportioned relative to the manganese content and the subsequent heat treatment that the steel formed be what is known in the art as a high manganese pearlitic steel. It has been found that the high manganese pearlitic steel might, if desired, be high in silicon, but this is not an essential part of the present invention. It is found, by way of illustration, that this invention may be practiced with a high degree of success when the steel is made containing the following substances in the proportions specified:

Manganese	1.00% to 2.50%
Carbon	20% to .60%
Silicon	.20% to 1.50%
Copper	.50% to 2.00%

Balance iron and a small amount of other substances occurring as impurities.

The copper may be added to the steel in the form of pure metallic copper and in practice this will undoubtedly be the desired method, but it is to be understood that any form of copper or copper containing substance may be introduced for the purpose of providing

in the final product the desired copper content.

It has been found in practice that the high manganese steel of the above character, having the specified amount of copper as a constituent, possesses the properties above enumerated and that an especially improved steel is produced.

To illustrate the hardness penetration, which hardness is less affected by subsequent drawing or heating to comparatively low temperatures, the applicants have conducted a simple test given below, which conclusively shows the advantages of this invention.

Two high manganese pearlitic steels were taken, one with no copper and one with copper present. Bars one inch square and six inches long were heated slightly above the upper critical temperature and then the ends were immersed to a depth of one inch until the bars were cool. The Brinell hardness numbers were then taken, after which the bars were heated or drawn at 850° F. for sixteen hours. The Brinell hardness numbers were again taken. The following results were obtained by such test:

	Steel free of copper	Steel with 1.07% of copper present
Maximum hardness	550	580
Hardness ¾″ from water line	340	370
Maximum hardness after drawing at 850° F.	370	410
Hardness at ¾″ from water line after drawing at 850° F.	300	350

Attention is further directed to the fact that the steel herein described has such properties that it lends itself peculiarly with extraordinary advantage to the manufacture of car wheels in that the properties which are realized in this steel answer so satisfactorily the problems which are encountered in steel failures in car wheels in service.

It will be readily appreciated from the above description that we have not only made an improved steel, which may be used for any purpose where its properties are desirable, but that we have also provided an improved car wheel which is capable of longer life and better service and one which is free from the main disadvantages heretofore encountered.

It is to be further understood that this steel, whether it be applied to car wheels or other articles, serves equally well, whether the article be cast or made by a forging, rolling, or other operation.

We claim:

1. A car wheel composed of a high manganese pearlitic steel containing copper in the quantity of from .50% to 2.00%.

2. A car wheel composed of high manganese pearlitic steel, containing manganese in the quantity of from 1.00% to 2.50% and copper of from .50% to 2.00%.

3. A cast car wheel composed of a high manganese pearlitic steel containing copper in the quantity of from .50% to 2.00%.

4. A cast car wheel composed of high manganese pearlitic steel, containing manganese in the quantity of from 1.00% to 2.50% and copper of from .50% to 2.00%.

Signed at Indiana Harbor, Indiana, this 29th day of November, 1927.

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