

UNITED STATES PATENT OFFICE.

WINFIELD C. HAMILTON AND CLARENCE E. SIMS, OF CHICAGO, ILLINOIS, ASSIGNORS
TO AMERICAN STEEL FOUNDRIES, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW
JERSEY.

STEEL.

No Drawing.

Application filed December 3, 1927. Serial No. 237,584.

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 pearlitic 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 particu-

larly 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 chromium 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:

	Per cent.
Manganese.....	1.00 to 2.50
Carbon.....	.20 to .60
Silicon.....	.20 to 1.50
Chromium.....	.50 to 2.00
Balance, iron and a small amount of other substances occurring as impurities.	

The chromium may be supplied and added to the metal in any form which is desired, it only being necessary to assure that the final product has the proper chromium content, but for the purpose of illustration it is preferred to add the chromium in the form of ferro-chromium, a well known form of which contains approximately 65% of chromium.

It has been found in practice that the high manganese steel of the above character, having the specific amount of chromium 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.

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

	Steel free of chromium.	Steel with .53% chromium present.
20 Maximum hardness.....	550	600
Hardness 3/4" from water line.....	340	480
Maximum hardness after drawing at 850° F.....	370	430
25 Hardness at 3/4" from water line after drawing at 850° F.....	300	390

Attention is further directed to the fact that the steel herein described has such properties that it lends itself peculiarly with
30 extraordinary advantage to the manufacture of car wheels in that the properties which are realized in this steel answers 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
40 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 chromium 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 chromium of from .50% to 2.00%.

3. A cast car wheel composed of a high manganese pearlitic steel containing chromium 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 chromium of from .50% to 2.00%.

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

WINFIELD C. HAMILTON.
CLARENCE E. SIMS.