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MANUFACTURE OF ROLLED STEEL PRODUCTS

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1 Claim. (Cl. 148—20)

This invention relates to the manufacture of rolled steel products, such as steel rails which are subjected to hard wear and have to withstand repeated shocks, and has as its object the production of an article of greater hardness, of better wearing quality and at the same time greater resistance against breakage than has heretofore been produced by the usual method of manufacture.

Steel rails are made of a carbon steel usually containing about .50% carbon. The percentage of carbon has been greatly increased during the past thirty years in order to improve the wearing quality of the rail through increased hardness. With a higher carbon content the ductility has naturally been lessened and brittleness of the rail has been increased with the result that the safety factor regarding breakage in service has been impaired. Various attempts have been made to increase the hardness of the rail without impairing the toughness by the addition of alloys, but such attempts have been only partially successful owing to the fact that the addition of hardening alloys has again a tendency to increase the brittleness and at the same time has unduly increased the cost of manufacturing. The introduction of a high percentage of manganese into the steel has resulted in a product combining wearing qualities with strength, but it was found that a content of above 12% manganese was needed in order to get the best results and the production of a manganese steel of this quality is so costly that its use has not been generally adopted for rails, but has been confined to switches, frogs, crossings and other special articles subjected to excessive wear. We are familiar with British Patent No. 324,686 covering the slow cooling of rails at temperatures below the critical range and after the steel has taken its final grain formation. This treatment does not accomplish the results which are the purpose of this invention.

My invention overcomes the difficulty of having to use a high percentage of expensive elements in the steel in order to produce a product combining superior wearing qualities with toughness.

I have found that a steel rail having better wearing qualities than the rail now in general use can be obtained by a relatively small addition of hardening elements, providing the steel after rolling is subjected to a special cooling process through its critical range. I have found that a steel containing approximately one-half of 1% of chromium and 1% of manganese with the usual carbon content, if slowly carried through its critical range at temperatures between 900 and 600 degrees C., preferably during a period of thirty minutes, will have durability and toughness far exceeding those of the ordinary carbon rail, also a remarkable freedom from transverse fissures.

One of the objects of my invention is to carry out the process of retarding cooling without interfering with the continuous production of the rolling mill, whether it be rails or other sections of steel. As the rails are delivered hot from the mill, I preferably cause them to pass through a chamber in which I can control the temperature, instead of delivering them to the usual cooling bed. This chamber is of such dimensions as to accommodate a sufficient number of rails to permit them to remain in the chamber for the time required for the heat treatment without interfering with the output of the mill. Preferably the rails are fed into one end of the chamber and withdrawn from the other end of the chamber continuously by means commonly employed in the handling of steel in the finishing end of rolling mills.

The chamber should be so constructed that under normal conditions with the usual size of rails and with the usual temperature when the rail is delivered from the mill a heat balance will be maintained, allowing the rails to pass through their critical temperature while in the chamber and delivering them from the chamber at a point below the critical temperature. If necessary external heat may be applied to the chamber or the chamber may be cooled to accomplish the desired result.

While I have described the method of carrying out my invention, I do not limit myself to this particular method of treating the steel and I intend to employ reasonable variations in the composition of my steel with regard to the elements therein contained, such as carbon, silicon, sulphur, phosphorus, as well as the hardening elements which I am adding. These hardening elements may be a combination of manganese with chromium as outlined, or manganese and chromium may be replaced by nickel, tungsten, or molybdenum in the percentages which will be equivalent in obtaining the wearing and toughening results.

I claim:

The method of producing a steel rail containing approximately .50 percent carbon, 1% manganese and .50 percent chromium, which comprises using its rolling heat for maintaining a slow cooling through the critical range of temperature of from approximately 900° C. to 600° C., and air cooling the rail below said temperatures.

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