

UNITED STATES PATENT OFFICE.

WINFIELD S. POTTER, OF NEW YORK, N. Y., ASSIGNOR TO ALLOY STEEL FORGING COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

MANUFACTURE OF CHAINS.

1,018,363

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, WINFIELD S. POTTER, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in the Manufacture of Chains; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the manufacture of chains as, for instance, chains consisting of the ordinary interlocked round section oval links.

It has for its object the production of a chain of manganese steel whose links have throughout a strength and capacity to resist shocks and strains substantially equal to the metal in the original unbroken bar or shape from which the links are formed.

It also relates, generally, to the welding of manganese steel.

It is particularly the purpose and object of my invention to avoid the separations, segregations, and irregular or coarse recrystallizations, with their consequent weakening of and injury to the high carbon manganese steel suitable for the purpose, which occur when a wrought bar or other blank shape of such steel is reheated to a high temperature, after the original forming of said bar or blank shape, during the welding operation.

In the practice of my invention, the rod or other blank shape from which the chain is to be formed (hereinafter referred to as the bar), is suitably produced by heating a manganese steel billet preferably to about 1175° C. to 1200° C., rolling the billet to the section of link intended, and completing the working of the metal during the forming of the bar at a finishing heat below 1075° C. If, after leaving the finishing pass of the mill the bars are to be air-cooled before the next succeeding step of the operation, the finishing heat of rolling should be in the neighborhood of 1075° C. for small bars which cool quickly in the air, and proportionately less for large bars, as, for example, the temperature in the last pass of the rolls should be about 800° C. to 950° C. for bars of 2 inches thickness. A bar of any required size for chain-making may be finished at temperatures between 800° and 1075° C.,

with good results, it immediately quenched in water. With thin bars, the cutting and forming into open links prior to the welding operation may sometimes be done cold, but it will usually be found more suitable to bring the links to form by cutting the bar into pieces, bending and interlocking the pieces of the intended chain at temperatures between 350° C. and 1025° C., according to the size of the bar. That is to say, at the time of its conversion into chain, the rolled bar should preferably have a temperature within the range of 350° C. to 1025° C., and usually 975° C. or closely approximating that temperature. It is then delivered to and speedily passed through the bar-cutting, link-forming and link-interlocking mechanism.

The rolled bar may be supplied to the chain-forming mechanism, hot from the heat of forming, or after having been reheated to the appropriate temperature. To maintain the temperature of the rolled bar after it leaves the forming rolls, it may be introduced as it issues from the forming rolls into a hot furnace compartment, or other heater, having at the time of entry of the hot rolled bar a temperature preferably of about 975° C. Or, if the bar has been permitted to cool and requires reheating, it is restored to substantially the same temperature with which it left the rolls, by rapidly reheating it, that is to say, by reheating it during a time too short to permit the metal to recrystallize in any objectionable way. In any event, the bar is subjected to the cutting, link-forming and link-interlocking action of the chain-forming mechanism and otherwise prepared for welding, and, as hereinbefore indicated is supplied to the chain-forming mechanism, either cold, or hot from the heat of forming, or after it has been cooled and subsequently reheated.

The welding may be accomplished by causing an electric current to flow between the surfaces to be welded while these surfaces are forcibly pressed together. The pressure applied at the weld is continued after the metal has been caused to flow and after the desired weld has been produced, in order to compensate for the weakening tendency of the high temperatures incident to the welding operation at or in the neighborhood of the weld. This continued application of force and pressure tends to sup-

press and avoid the relatively coarse, weak and undesirable recrystallization of the metal adjoining the weld, which would otherwise occur. The metal at the weld is further pressed, forged, or otherwise wrought, until thoroughly worked throughout and finally at a temperature preferably between 800° C. and 1000° C., or thereabout, so that the portions of the link highly heated during the welding operation will be brought to a condensed and a very fine-grained condition throughout. Consequently, as the welded chain issues from the forging or pressing mechanism, it consists of links which fully retain throughout their entire length, including the weld, all of the useful effects of the work and compression produced by the rolls in forming the billet into the rolled bar. In fact, at the surfaces where the links have been welded the metal is even still further compressed and improved by the force and pressure applied during the forging operation.

To illustrate a typical instance of the practice of the invention, it will be assumed that the metal to be formed into a chain is manganese steel having in its composition carbon approximately 1.20 per cent., manganese 12 per cent. A billet of this metal is heated to about 1175° C. throughout and is rolled, for example, to a round bar of the diameter of the section of a link of the intended chain. The bar is caused to issue from the rolls at a temperature between 800° C. and 1075° C. (preferably 975° C.) and is thereupon quickly introduced into the heater which will have about the same length as the bar and wherein about the same temperature will be maintained. In order to avoid any material loss of heat by the bar or any change in the condition or structure of its steel, the bar is then delivered from the heater and through the chain-forming and welding mechanism in such manner that the cutting off into link-lengths, the forming of the links, the welding of the links, the forging of the welded portions and the final issuance of the welded chain from the chain-forming and welding mechanism is accomplished rapidly so that the completed chain has as nearly as possible the same temperature that the bar has on leaving the rolls. Local inequalities or unevenness in the temperature of the finished chain may be compensated and equalized by a short heating operation at about 800° C. to 1075° C. The chain is then quickly cooled by immersion in water, or the finished chain may be otherwise rapidly cooled to a temperature below 420° C. Or, after welding and pressing the links, they may be reheated to about 975° C. to 1025° C., reworked at the welds, and then quenched or otherwise rapidly cooled.

In order to avoid the occlusion of slag

or other foreign matter in the weld, the cutting of the bar into lengths is preferably so executed that the surfaces which are to meet and by their flow form the central portion of the intended weld project beyond the remainder of the surfaces to be welded; so that, when the welding heat and the pressure is applied, the weld occurs first at the center and then progressively outwardly toward the edges until the weld is complete.

What I claim is:

1. The method of producing wrought manganese steel chain, which consists in cutting a bar of manganese steel into pieces suitable for links; bending and interlocking the pieces and electrically welding their ends to form links; thoroughly working the welded portions at temperatures below 1075° C.; heating the links to about 1000° C.; and rapidly cooling to below 420° C.; substantially as described.

2. The method of producing wrought manganese steel chain, which consists in heating a bar of manganese steel to between 350° C. and 1075° C.; cutting the bar into pieces suitable for links; bending and interlocking the pieces and electrically welding their ends to form links; thoroughly working the welded portions at temperatures below 1075° C.; heating the links to about 1000° C.; and rapidly cooling to below 420° C.; substantially as described.

3. The method of producing wrought manganese steel chain, which consists in heating a bar of manganese steel to between 350° C. and 1075° C.; cutting the bar into pieces suitable for links; forming and interlocking the pieces and electrically welding their ends to form links; thoroughly working the welded portions at temperatures between 800° C. and 1075° C.; heating the links to about 1000° C.; and rapidly cooling to below 420° C.; substantially as described.

4. The method of producing wrought manganese steel chain, which consists in heating a manganese steel billet to about 1175° C.; rolling the billet to bar form with a finishing temperature below 1075° C.; cutting the bar into pieces while still hot from the heat of rolling; bending and interlocking the pieces and electrically welding their ends to form links; thoroughly working the welds at temperatures between 800° C. and 1075° C.; equalizing the temperatures in the links at about 1000° C.; and rapidly cooling to below 420° C.; substantially as described.

5. The method of welding, working and heating manganese steel, which comprises bringing the ends to be welded to a welding heat; pressing the said ends together; thoroughly working the welded portions at temperatures below 1075° C.; and rapidly cooling to below 420° C.; substantially as described.

6. In the production of wrought manganese steel chain, the method of welding, working and heat-treating the links, which comprises bringing the ends to be welded to a welding heat; pressing the said ends together; thoroughly working the welded portions at temperatures below 1075° C.; and rapidly cooling to below 420° C.; substantially as described.

7. In the production of wrought manganese steel chain, the method of welding, working and heat-treating the links, which comprises bringing the ends to be welded to a welding heat; pressing the said ends together; thoroughly working the welded portions at temperatures below 1075° C.; equalizing the temperature in the welded and worked links between 800° C. and 1075° C.; and rapidly cooling to below 420° C.; substantially as described.

8. In the production of wrought manganese steel chain, the method of welding, working, and heat-treating the links, which comprises bringing the ends to be welded to a welding heat by the passage of an electric

current; pressing the said ends together; thoroughly working the welded portions at temperatures below 1075° C.; heating the welded and worked links to about 1000° C.; and rapidly cooling to below 420° C.; substantially as described.

9. In the production of wrought manganese steel chain, the method of welding, working and heat-treating the links which comprises heating the blanks from which the links are to be formed to about 1000° C.; forming the links; bringing the ends to be welded to a welding heat; pressing the said ends together and thereby welding them; thoroughly working the welded portions at temperatures below 1075° C.; and finally cooling the metal rapidly from about 1000° C. to below 420° C.; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

WINFIELD S. POTTER.

Witnesses:

M. A. BILL,

JOHN C. PENNIE.