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 PINS, LINKS, AND THE LIKE FROM MANGANESE STEEL.

1,018,361. Specification of Letters Patent. Patented Feb. 20, 1912.

No Drawing. Application filed February 27, 1911. Serial No. 611,231.

To all whom it may concern:

Be it known that I, WINFIELD S. POTTER, a citizen of the United States, residing at New York city, county of New York, State of New York, have invented certain new and useful Improvements in the Manufacture of Pins, Links, and the Like from Manganese Steel; 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 certain new and useful improvements in the manufacture, from manganese steel, of conveyer pins, dredger pins, chain pins, links, bushings, beater arms for pulverizing mills, grate bars, or grizzly bars for separator chutes, and, in general, similar shapes, requiring a high degree of resistance to abrasion or wear, and superior qualities of toughness, stiffness and tensile strength.

In carrying out my invention, I usually heat a billet or blank of manganese steel to a temperature above 1125° C. and preferably to about 1150° C., until the metal is brought into a uniform and ductile condition throughout although, for some purposes, heating for a suitably long period at a temperature as low as 1050° C. may suffice. The blank is then rolled to form a bar and with a finishing temperature in the exterior parts at between about 800° C. and about 1075° C. although a higher temperature and softer condition may prevail in the center of the bar. In the case of such conveyer pins or like shapes as may require punching for the purpose of forming small cotter pin holes or the like therein, or which require considerable ductility for the forming of the head portion of a pin, for example, the higher central temperature is desirable and in many cases necessary. When the bar is to be converted into a beater arm or hammer for a pulverizing mill, however, a very high central temperature (*i. e.*, a temperature materially above 1075° C.) is undesirable, for the reason that when thus employed the entire cross section of the bar is wearing metal, and will be of better quality if finished at a nearly equal temperature below about 1075° C. In the case of conveyer pins however, having cotter pin holes a thin layer about the circumference of the cylindrical parts of the pin only is worn away before the pin is discarded, so that the only portion of the bar corresponding to these wearing parts of the pin need issue from the rolls at the low temperature which will secure the qualities desired. It will be understood, also that the center temperature with which the bar leaves the finishing pass of the rolls should be correspondingly determined to accord with the particular use for which the ultimate product is intended, and with the ductility necessary for final forming.

On its delivery from the finishing pass of the rolls, the bar may be placed in a suitable heater or heating furnace so as to prevent any considerable change in the average temperature of the bar before it is subjected to the next step of the operation, namely, cutting the bar off into suitable lengths for the pin, beater arm, or the like to be produced. The heater in which the hot bar is placed, upon issuing from the finishing pass of the rolls, should have a temperature preferably of about 950° C., or such a temperature that the worked surface of the bar shall not become reheated by its hotter center to such a temperature as would cause the outer parts of the bar, corresponding to the wearing parts of the finished pin or other shape, to be recrystallized and thus to lose the dense wrought condition due to the rolling. Where the shape to be produced is a conveyer pin, for instance, one end of the rolled bar is engaged by the feeding mechanism of a heavy punch press or other machine to which the bar is rapidly fed. As the bar passes through this machine, it is cut to the desired lengths, and has its ends formed by pressing, swaging, punching of holes, etc., as may be desired. The partly-formed pieces, thus produced may be immediately delivered without material loss of heat to a second furnace or heater having a temperature ranging preferably from about 800° C. to 1075° C. or if the pieces have been finished in the punch press or other machine, they may be immediately quenched in water. Such partly-formed blanks as require further forming are now withdrawn rapidly one after the other from the last mentioned heater, and are inserted in the dies of a bull dozer or other suitable mechanism for completing the forming, as, for example, forming the end of the pin, which has hitherto been left blank, into an upset head or other-

wise as may be desired. The pins are now removed from the bull dozer and immediately quenched in water or otherwise rapidly cooled from a substantially equal temperature of about 950° C. or the finished pieces may be held in a furnace for a short time at about their average finishing temperature, to eliminate forging strains, before quenching.

It is important that, after the bar has once been rolled, the metal should undergo no considerable rise of temperature in the outer portions of the piece after the bar has issued from the finishing pass of the rolls. It is also important that at no time during the operation should any portion of the bar be permitted to cool materially below 800° C. or thereabout, except that perhaps some portion of the surface during the steps of forming the piece may momentarily be somewhat colder while the bar is in contact with the rolls, cold dies, punches, etc., which form it.

When small holes are to be punched through thick bars, the bar is preferably caused to enter the punching press with a center temperature considerabl above that of the surface. This renders the punching operation easier, while preserving the results of the low temperature rolling in the surface and outer layers of metal in the bar. In the second heater, the surface temperature of the bar is raised but slightly, if at all, while the temperature of the whole piece becomes substantially equal, at about 950° C., at which temperature the surface of the bar is preferably maintained from the time it leaves the final pass of the rolls. While I prefer to thus maintain the bar at or about this temperature of 950° C. yet, as hereinbefore indicated, it may have a wider range of temperature, but in no case should it be permitted to fall substantially below 800° C. at any time during the cutting-off or forming operations.

Instead of rolling a long bar and feeding it from the heater to the punching and cutting machine hammer or press, the billet or blank from which the bar is rolled may be smaller, so that a shorter bar will result. This will have the advantage that the shorter bar may be more speedily cut up into the desired lengths and worked into the partly formed pieces, and, consequently will lose but a slight amount of heat before the next step of the operation occurs which may be the final rapid cooling, or which may be completing the intended shape prior to such rapid cooling. When the bar produced is sufficiently short, or if the forming operations are conducted with sufficient rapidity, said operations may be completed without a drop in temperature below the required range, and consequently without the necessity of employing a heating furnace or furnaces to avoid incidental temperature losses.

What I claim is:

1. The method of forming pins, links, and the like, from manganese steel, which consists in heating a blank of manganese steel until in a uniform and ductile condition, then rolling the heated blank to form a bar having a dense wrought condition in the parts intended to act as wearing surfaces, cutting the bar into lengths, mechanically working the lengths into the intended shapes while preserving in the wearing parts the desirable wrought state, which those parts had at the completion of the rolling operation, and finally cooling rapidly; substantially as described.

2. The method of forming pins, links, and the like, from manganese steel, which consists in heating a blank of manganese steel until in a uniform and ductile condition, then rolling the heated blank to form a bar having a dense wrought condition in the parts intended to act as wearing surfaces, cutting the bar into lengths, mechanically working the lengths into the intended shapes while maintaining the temperature of the wearing parts within a range which will prevent any substantial loss of their dense wrought condition, and finally cooling rapidly; substantially as described.

3. The method of forming pins, links, and the like, from manganese steel, which consists in heating a blank of manganese steel to a temperature higher than 1125° C., then rolling the heated blank to form a bar having a surface temperature in the parts intended for wear not substantially lower than 800° C. nor substantially above 1075° C., maintaining the temperature of said surfaces within said range of temperature while the bar is being cut up into lengths and formed into the pins or the like to be produced, and finally rapidly cooling the finished pieces; substantially as described.

4. The method of forming pins, links, and the like, from manganese steel, which consists in heating a blank of manganese steel to a temperature higher than 1125° C., then rolling the heated blank to form a bar having a surface temperature in the parts intended for wear not substantially lower than 800° C. nor substantially above 1075° C., and a higher interior temperature appropriate to punching, maintaining the temperature of said wearing parts within said range of temperature while the bar is being cut up into lengths and formed into the punched pins or the like to be produced, and finally rapidly cooling the finished pieces; substantially as described.

5. The method of forming pins, links, and the like, from manganese steel, which consists in heating a blank of manganese steel to a temperature higher than 1125° C.,

then rolling the heated blank to form a bar having a surface temperature in the parts intended for wear not substantially lower than 800° C. nor substantially above 1075° C., maintaining the temperature of said surfaces within said range of temperature while the bar is being cut up into lengths and formed into the pins or the like to be produced, removing forging strains by equalizing the temperature in the pieces, and finally rapidly cooling; substantially as described.

6. The method of forming pins, links, and the like, from manganese steel, which consists in heating a blank of manganese steel to a temperature higher than 1125° C., then rolling the heated blank to form a bar having a surface temperature in the parts intended for wear not substantially lower than 800° C. nor substantially above 1075° C. maintaining the temperature of said surfaces within said range of temperature while the bar is being cut up into lengths and formed into the pins or the like to be produced, removing forging strains by equalizing the temperature in the pieces, for a short time, at about their finishing temperature, and finally rapidly cooling; substantially as described.

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

WINFIELD S. POTTER.

Witnesses:
LEON W. ROSENTHAL,
WILLIAM H. DAVIS.