UNITED STATES PATENT OFFICE.

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MANUFACTURE OF SHEETS OR PLATES OF MANGANESE STEEL.

1,017,908. Specification of Letters Patent. Patented Feb. 20, 1912.

No Drawing. Application filed January 10, 1912. Serial No. 670,376.

To all whom it may concern:

Be it known that I, WINFIELD S. POTTER, a citizen of the United States, and residing at the Apthorp Apartments, at the corner of Broadway and Seventy-eighth street, in the borough of Manhattan, in the city, county, and State of New York, have invented certain new and useful Improvements in the Manufacture of Sheets or Plates of 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.

In an application for Letters Patent of the United States filed by me under date of November 4th, 1911, Serial No. 658,425, I have described the manufacture of sheets or plates from manganese steel billets or blanks (having a percentage of manganese above 5½ per cent. and usually containing about 12 per cent.), the final product of the operation being of a substantially uniform, fine-grained condition throughout, and having the desired stiffness or ductility appropriate to the use for which it is intended.

In my application referred to, the method described involves first heating the manganese steel billet or sheet bar until it is brought into a uniform and ductile condition throughout, appropriate to the rolling operation. To this end, the necessary plasticity is imparted to the billet or sheet bar, by raising it to a temperature which, for the production of the best results, will usually be above the melting point of the eutectic alloy, that is, above 1125° C. (say 1125° C. to 1225° C., according to the ductility required for rolling), but which, in some instances, may be as low as 1060° C., provided subsequent reduction from the billet to the sheet or plate in a single heat is not considerable.

In accordance with the present invention, the blank in the condition of ductility to which it has been brought by the heating operation referred to, will be thoroughly worked, by a partial rolling operation, which terminates at a temperature from 800° C. to 1075° C., and thereafter continuing the rolling operation with light pressure and slight reductions (according to the stiffness desired) until at the completion of the operation, the temperature has fallen so low that reversion out of the uniform, austenite condition of the metal is impossible.

In the practice of the present invention, the initial heating of the blank is preferably carried to temperatures above 1125° C., and the rolling, up to the time of nearly completing the reduction to finished dimensions, should be carried on rapidly, with considerable reductions in each stage of the rolling, so that the steel is brought to a fine-grained, wrought condition. Thereafter, the rolling, which is preferably conducted in rolls which are supplied with a considerable amount of cooling water, is so conducted that in each passage through these rolls, the metal is not considerably reduced or elongated, thereby avoiding any undue straining or stiffening of the product. This secondary rolling and coincident cooling should be continued until the metal approaches a black heat, or even below the black heat, that is, at temperatures ranging from 550° C. to 400° C., or lower.

It is characteristic of the present invention that rolling in the ordinary manner, that is to say, with heavy reductions, is avoided at temperatures below 800° C., and particularly below 720° C., below which latter temperature rolling with heavy reductions leaves the metal in a very stiff and brittle condition, similar to that produced by the cold-rolling or wire-drawing of mild steel, so that in such case, a subsequent annealing operation is necessary to relieve the sheet or plate of strains or stiffness. I have found, however, that by continuing the rolling at temperatures below this limit with a moderate amount of pressure, such, for example, as the weight of the ordinary sheet roll but with inconsiderable reductions or elongations, the metal is not only tough because of the avoidance of the excessive reduction at the lower heat, but may be cooled entirely without having suffered those separations which would have occurred during the cooling if not accompanied by the pressure of the rolls. For example, if the plate were brought to finished dimensions by rolling until at a temperature of above 720° C. and then air-cooled until at the ordinary temperature, the air-cooled sheet having suffered alterations in cooling from 720° C. to 420° C. would lack the desired ductility and toughness; whereas, if subjected to the pressure of the rolls with but light reductions, the separations which might have occurred at temperatures below 720° C. are avoided, and the finished sheet

is strong and tough, and has a ductility corresponding to the temperature at which the heavy reductions were terminated and the lighter reductions begun.

By using water on the rolls during the rolling with but light reductions, the more rapid cooling incident to the contact with the cold, wet rolls further tends to obviate the separations incident to slow cooling without applied pressure.

Having thus described my invention, what I claim is:

1. The method of making sheets or plates of manganese steel, which comprises heating a billet or blank of manganese steel until in a uniform and ductile condition throughout, partially rolling until in a thoroughly worked condition at temperatures which, in the finishing stage of the partial rolling, are between 800° C. and 1075° C., thereafter working with light pressure and but slight reductions until the temperature has fallen so low that reversion out of the uniform, austenite condition will not take place; substantially as described.

2. The method of making sheets or plates of manganese steel, which comprises heating a billet or blank of manganese steel until in a uniform and ductile condition throughout, partially rolling until in a thoroughly worked condition at temperatures which, in the finishing stage of the partial rolling, are between 800° C. and 1075° C., and thereafter working with light pressure and but slight reductions, together with gradual water-quenching until the temperature has fallen so low that reversion out of the uniform, austenite condition will not take place; substantially as described.

3. The method of making sheets or plates of manganese steel, which comprises heating a billet or blank of manganese steel until in a uniform and ductile condition throughout, partially rolling until in a thoroughly worked condition at temperatures which, in the finishing stage of the partial rolling, are between 800° C. and 1075° C., and thereafter working with light pressure and but slight reductions to substantially a black heat; substantially as described.

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

WINFIELD S. POTTER.

Witnesses:
JOHN C. PENNIE,
MINERVA LOBEL.