UNITED STATES PATENT OFFICE.

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MANUFACTURE OF SHEETS OR PLATES OF MANGANESE STEEL.

1,018,002. Specification of Letters Patent. Patented Feb. 20, 1912.

No Drawing. Application filed January 10, 1912. Serial No. 670,377.

To all whom it may concern:

Be it known that I, WINFIELD S. POTTER, a citizen of the United States, 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 4, 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 the 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, may then be rolled at a temperature which, in the finishing stage of the rolling may be below 800° C., as, for example, a temperature as low as 500° C. The product will then require a reheating or annealing operation to obtain a suitably tough product for most purposes, inasmuch as rolling at temperatures below 800° C., and particularly below 720° C., leaves the metal in a very stiff and brittle condition, similar to that produced by the cold rolling or wire-drawing of mild steel. If, for example, the sheet or plate is finished at a temperature of say, 700° C. or lower, it is reheated for the purpose of bringing it back to a suitable condition of toughness and ductility. For the purposes of this reheating of sheets finished at these low temperatures, the reheating furnace will usually be maintained at a temperature of about 975° C. to 1075° C., and the sheet or plate will be kept in the furnace for such time only as is necessary to bring it to the furnace temperature and to effect the re-solution of such carbids as have separated out during the cooling of the steel.

In case the minimum stiffness consistent with a tough and coherent condition of the metal is desired, the sheet or plate may be held in the furnace for a slightly longer time with some softening and re-graining effects; but, in this case, care should be taken that the sheet or plate does not attain, for any considerable time, a temperature much, if any, more than about 1025° C., or that it remains long at any equalized temperature above about 975° C.

When the sheet cannot be finished with the intended dimensions in a single heat, the billet or sheet bar may be partially rolled to any temperature either above or below 800° C., and even down to say 500° C., and then reheated to a temperature sufficient to give it the necessary ductility for rolling to finished form, and, if worked to finished dimensions at a temperature which, in the finishing stage, is below 800° C. (say 700° C. or lower), it should then be brought to the suitable condition of toughness and ductility by reheating it to a temperature such that any carbids which may have separated are restored to solution by heating to say from 975° C. to 1075° C.; or, if rapidly cooled and rapidly reheated after the final rolling, the sheet may be annealed and rendered ductile by reheating to any temperature between about 800° C. and 1075° C. In any case, the sheet or plate is retained in the furnace for such time only as is necessary for it to assume throughout the furnace temperature, whereupon the metal will be re-grained or restored to uniformity by the re-solution of any carbids which may have separated. In order to further anneal and increase the ductility of the metal without impairing the tough and coherent condition

afforded by the previous heating and working, the sheet or plate may be held in the furnace for a short time after it has assumed the furnace temperature, care being taken that it shall not attain for any considerable time, a temperature much, if any, more than about 1025° C. and that it shall not remain long at any equalized temperature above about 975° C.

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, rolling and thereby working at temperatures which, in the finishing stage, are below 800° C., reheating until any separated carbids have been taken into solution; and quenching; 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, rolling and thereby working at temperatures which, in the finishing stage, are below 800° C., reheating at temperatures between 975° C. and 1075° C.; and quenching; 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, rolling and thereby working, with intermediate reheating, the working being effected at temperatures which, in the finishing stage, are below 800° C., reheating to restore ductility; and quenching; substantially as described.

4. 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, rolling and thereby working at temperatures which, in the finishing stage of the working, are below 800° C., reheating until any separated carbids have been taken into solution and continuing the reheating for such time only that the plate is suitably annealed or toughened; and quenching; substantially as described.

5. In the manufacture of sheets or plates of manganese steel, by rolling a billet or blank of manganese steel previously heated until in a uniform and ductile condition throughout, the method of restoring to solution any carbids which may have separated in the rolled metal which consists in reheating the rolled metal to temperatures between 975° C. and 1075° C.; and quenching; substantially as described.

6. In the manufacture of sheets or plates of manganese steel, by rolling a billet or blank of manganese steel previously heated until in a uniform and ductile condition throughout, the method of restoring to solution any carbids which may have separated in the rolled metal and annealing or toughoning the metal, which consists in reheating the rolled metal to temperatures between 975° C. and 1075° C. for such time only that the sheet or plate is suitably annealed or toughened; and quenching; substantially as described.

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

WINFIELD S. POTTER.

Witnesses:

JOHN C. PENNIE,

MINERVA LOBEL.