

UNITED STATES PATENT OFFICE.

WINFIELD S. POTTER, OF NEW YORK, N. Y., ASSIGNOR TO MANGANESE STEEL RAIL COMPANY, OF MAHWAH, NEW JERSEY, A CORPORATION OF NEW JERSEY.

TREATING MANGANESE STEEL.

939,163.

Specification of Letters Patent.

Patented Nov. 2, 1909.

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 at New York, borough of Manhattan, in the county of New York and State of New York, have invented a certain new and useful Improvement in Treating Manganese Steel, of which the following is a specification.

This invention relates to the treatment of manganese steel ingots for the purpose of forming a strong, tough envelop on the outer portion thereof preparatory to rolling the same, and relates particularly to the treatment of ingots having defects in the outer portion thereof due to casting conditions, and to other defects such as cracks, slag pits and cold shuts, and also to the treatment of ingots which have been injured to a greater or less extent by rapid heating.

In the treatment of manganese steel, if an ingot is permitted to cool from the heat of casting to a considerable depth, measured inward from its surface, and to temperatures below the recrystallization point of the steel, the skin portion crystallizes with a fine and substantially uniform structure, this outer portion, however, constituting a very thin layer. As the metal below this skin cools more slowly, the crystals formed in the outer portion adjacent to the skin, assemble in columns at right angles to the finely crystallized skin, and extend toward the center of the ingot to a considerable depth, in some instances as much as 3 inches. The interior portions of the ingot crystallize in a substantially uniform manner, and result in an interior structure different in character from the columnar structure above referred to. If the ingot, in this condition, be placed in a soaking pit, and rapidly heated, the finely crystallized skin will be cracked and the columns or fibers constituting the columnar portions separated by rapid expansion; the surfaces of the columnar aggregations of crystals may also be oxidized, so that special heat treatment will be necessary to make the metal constituting this portion of the ingot, cohere and weld into a continuous mass. Further, if the ingot in such condition be rapidly heated, the finely crystallized skin may partially separate from the columnar portions of the ingot, necessitating the complete removal of this skin before the metal can be brought into proper condition for working. Again, if an ingot, which is still

hot from the heat of casting, be delivered to the furnace, and heated rapidly to a higher temperature, the outer portions thereof are liable to be cracked.

The object of my invention is to so treat such an ingot as to form a strong, tough outer portion thereon, so that the metal will not rupture while being reduced or worked, and whereby a finished product may be obtained free from any defects.

In practice when the ingot is in the condition above described, that is, has a finely crystallized skin, and an adjacent crystalline columnar structure, or contains cracks, slag pits, cold shuts, etc., I heat the metal as desired to a high temperature, varying preferably from 1200° C. to 1300° C., that is, approximating but below the melting point. In case the interior portions of the ingot have been allowed to cool, the above heat is maintained until said interior portions have become soft and plastic, that is, at temperatures say from 1150° C. to 1300° C. If the cracks or imperfections are of considerable depth the metal may be compressed and the outer portions thereof lightly worked by means of a press, rolls, or other suitable mechanism, and until such outer portions are welded and firmly cohere throughout. If however, the cracks or imperfections are of but moderate depth, the ingot while still in the furnace may be quickly cooled, preferably to a temperature of about 1125° C., and to a depth below that of the imperfections or defects, which defects disappear by the elongation of the skin while the body of metal is being reduced to finished shape. These temperatures however, to which the metal is heated and cooled, depend largely upon the kind or character of the defects, the lowest predetermined temperature being maintained until the metal is uniformly or symmetrically cooled to a depth below that of the cracks or other imperfections. I have also found from experience, that in some instances it is advisable to employ both of the steps above suggested, that is, to cool the outer portions of the metal to a depth below that of the defects and subsequently compress and lightly work the metal prior to any substantial reduction of the same.

The cooling of the outer portions of the metal is effected in a non-oxidizing atmosphere and preferably by injecting steam, vapor or gas against the body of metal. In

case, however, the skin of the ingot has been partially burned so that it no longer coheres or forms a continuous structure with the adjacent parts, and has begun to separate therefrom as above described, I have found it desirable to remove this burned skin. This may be accomplished by subjecting the ingot to an oxidizing fluid or atmosphere for such length of time as will be sufficient to convert the burned skin into scale, whereupon it easily and readily separates from the ingot. After the burned skin has been removed in the form of scale or slag, the ingot is then preferably cooled to a depth below the cracks, or any defects that may remain, whereby during said cooling the outer portions of the ingot are contracted and welded. After the defects have been removed as above described, the ingot may be then subjected to the rolls, or if desired, first compressed and lightly worked as above suggested to complete the welding, and then subjected to the action of the rolls and reduced to finished shape.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. The process of treating a body of manganese steel which has been rapidly heated and the outer portions thereby injured, which consists in working said outer portions of the heated ingot without elongation until the same are welded and firmly cohere throughout.

2. The process of treating an ingot of manganese steel hot from the heat of casting, which consists in rapidly heating the outer portions of said ingot, then working said outer portions to weld the same and provide a strong and tough skin.

3. The process of treating a body of manganese steel, which consists in rapidly heating said body of metal to a temperature approximating but below the melting point, then working said body of metal to weld its outer portions, and to form a strong, tough skin.

4. The process of treating a body of man-

ganese steel having defects in its outer portions, consisting in heating said body of metal to a high temperature, then cooling the outer portions of said metal to a depth below that of the defects, and subsequently working said metal.

5. The process of treating a body of manganese steel having defects in the outer portions thereof, which consists in heating the metal to a temperature above 1200° C., cooling the outer portions thereof to temperatures below 1150° C., until the ingot is cooled symmetrically to a depth below said defects and subsequently working the same.

6. The process of treating a body of manganese steel having defects in the outer portions thereof, which consists in removing the skin by converting the same to scale, then welding the said outer portions, and subsequently working the metal.

7. The process of treating a body of manganese steel having defects in the outer portions thereof, which consists in oxidizing and removing the skin, then working the body of metal without elongation, and subsequently reducing the same to finished shape.

8. The process of treating a body of manganese steel having defects in the outer portions thereof, which consists in subjecting the metal to a temperature above 1200° C. in an oxidizing atmosphere, working the surface of said metal without elongation, then reducing it to finished shapes.

9. The process of treating a body of manganese steel having defects in the outer portions thereof, which consists in heating said body of metal in an oxidizing fluid to convert the skin to scale, then quickly cooling the metal until the outer portion thereof is cooled to a depth below the defects, and subsequently working said metal.

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

WINFIELD S. POTTER.

Witnesses:

JEREMIAH BALLER,
EDWARD BALL.