

# UNITED STATES PATENT OFFICE.

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## PROCESS OF TREATING STEEL INGOTS AND THE LIKE.

No. 887,286.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, BENJAMIN TALBOT, a subject of His Majesty the King of Great Britain, residing at Middlesborough, in the county of York, England, have invented a certain new and useful Process of Treating Steel Ingots and the Like.

This invention relates to an improved process of treating steel ingots, blooms, slabs, and like masses before they are rolled down into rails or other finished product, and it has for its object providing the steel mass with a surface or skin higher in carbon than is obtained when it is solidified or cooled in the usual way, whereby after rolling a harder wearing surface is obtained.

My invention is more particularly applicable to the manufacture of rails, as at the present time higher carbons than formerly are being asked for from the manufacturers of rail steel, and when the whole mass of the material forming the rail is as high in carbon as from .75 to 1.00 per cent. the rail is apt to become treacherous under hard conditions of wear, or if small fractures are made, or under very low temperatures, whereas if only the surface is hardened equally good wearing qualities in the rail are obtained.

My invention may be carried out as follows, in the case of an ingot for example:— As soon as the steel ingot is stripped from the ingot mold it is carried to an inclosed receptacle preferably lined with brickwork, which may be previously heated or not, or the receptacle may be of metal, such as cast iron. This receptacle may be for example some 8 to 10 inches larger than the ingot to be placed in it, or sufficient space must be left between the ingot and sides of the chamber to cause little radiation of heat. The ingot having been lowered centrally into this receptacle while at a high or suitable temperature for the work to be done, the intervening space between the sides of the hot ingot and the side of the receptacle is filled in as rapidly as possible with dry powdered coke, coal, or other suitable form of carbon, or carbonaceous material, or carbon in a gaseous state, which may be previously heated if desired. The carbon should be pressed in somewhat tightly between the ingot and the outer wall. Some form of mechanical ramming may conveniently be used, but care should be taken that the pressure is equally applied all round the exterior of the ingot. When completely filled the ingot is allowed

to remain thus covered for a length of time dependent on the amount of carbon to be absorbed by the surface, and by the size of the ingot. As a rule several hours are necessary, but the heat in the interior of the ingot will keep the metal hot for a very long time. It is in fact possible to partially melt the carbonized metal on the surface if care be not taken to prevent this. Under these conditions when the ingot is placed in contact with the carbonaceous covering, while its interior is liquid or semi-liquid, great heat is given out to the cooler surface of the ingot and it is this which permits the carbon to be more rapidly absorbed into the surface of the ingot, than if the center of the ingot was in solid condition.

It will be found that the carbon will have penetrated into the surface of the steel ingot, and one may thus obtain for instance about .75 to 1.00 per cent. of carbon on the surface while interior portions of the ingot has only about 0.50 to .75 per cent. or whatever percentage the steel may have been cast at. The carbonized ingot is then rolled, or forged, or preferably heated before being rolled down into a rail or other section in the ordinary manner, the finished article presenting a hardened attenuated skin or surface.

It is a known fact that segregation of carbon and impurities always takes place toward the center of an ingot or mass and the greatest amount generally occurs in the center or about say 25 per cent. from the top. In the present instance the slower cooling of the ingot will tend to decrease this effect and to improve the uniformity of the composition of the mass.

It is sometimes desirable that only part of the outer surface of the ingot or mass should be treated in this way, so that when rolled down, the harder part may form the wearing head of the rail, or article, the part forming say the web and flange in the case of a rail remaining of the same hardness as the mass of the steel. To accomplish this, when the hot ingot is put into the receptacle suitable division pieces may be inserted so that the carbon may be brought into contact with any wished for part of the ingot or mass and does not surround it on all sides as it would if such division pieces were absent.

Where the carbon entirely surrounds the ingot or mass a complete unbroken hardened skin or surface will be obtained in the finished article.



I am fully aware that masses have been carbonized by heating them in connection with coke powder or other suitable form of carbon, but in the case of my invention the latent and initial heat is employed.

What I claim is:

1. The process of treating steel, for the production of an article having an exterior portion or portions harder than the body of the metal, which consists in casting the molten metal, then placing a surface or surfaces of the mass and a hardening material in contact while the interior of the metal is still heated to or above plasticity, and utilizing the latent heat for effecting the exterior condition requisite for the absorption of the desired amount of said hardening material.

2. The process of treating steel, for the production of an article having a surface harder than the body of the metal, which consists in casting the metal and then placing the surface to be hardened and a hardening material in contact while the interior temperature of said metal is sufficient to produce a semi-liquid condition in the interior metal.

3. The process of treating steel, for the pro-

duction of a shape having a part harder than the remainder, which consists in casting the metal, then bringing together a hardening agent and the part of the metal to be hardened, utilizing the latent heat of the metal in effecting the desired absorption of said hardening agent, and then shaping said metal.

4. The process of treating steel, to effect surface carburization of and reduce segregation of carbon in the body, which consists in inclosing the cast metal in contact with carbon while only the interior of the mass is fluid, baffling the escape of the heat to effect slow cooling of the interior and utilizing the interior heat for securing the surface heat necessary for effecting absorption of carbon by the surface of the body.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

BENJAMIN TALBOT.

Witnesses:

G. S. MARSHALL,  
EDWD. T. FOSTER.