UNITED STATES PATENT OFFICE.

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

ROLLED MANGANESE-STEEL RAILROAD-RAIL.

987,167. Specification of Letters Patent. Patented Mar. 21, 1911.

No Drawing. Application filed September 26, 1908. Serial No. 455,230.

To all whom it may concern:

Be it known that I, WINFIELD S. POTTER, a citizen of the United States, residing at Mahwah, in the county of Bergen and State of New Jersey, have invented a certain new and useful Rolled Manganese-Steel Railroad-Rail, of which the following is a specification.

In my several pending applications for patents filed May 8, 1906, and renewed Jany. 31, 1907, Serial No. 355,136; filed Jany. 31, 1907, Serial No. 355,082; filed April 25, 1907, Serial No. 370,303; filed May 15, 1907, Serial No. 373,887; filed Aug. 2, 1909, Serial No. 510,858; and filed Sept. 22, 1909, Serial No. 518,929, and for which patents were issued on the second day of November 1909 and numbered respectively 938,891, 938,892, 939,084, 938,893, 939,163 and 939,164, I have referred to the treatment of manganese steel for the purpose of annealing, toughening, and working the same, and to methods and processes of producing finished shapes therefrom.

This invention relates to track rails rolled from manganese steel for use on steam and electric railroads.

Heretofore rails have been cast from manganese steel, but cast rails are objectionable because they contain the defects inseparable from cast metal, and because of the excessive cost of their production. Various attempts have also been made to roll rails of manganese steel, but the rails so produced have not been of standard size and section and have not been free from imperfections and defects and the character of the metal in the rails has not been uniform throughout.

It is the object of my invention to produce a rail which shall be free from the defects of cast rails, which shall possess the desirable qualities of worked or wrought metal, and which shall also be of uniform structure throughout and retain all the desirable characteristics of manganese steel.

My improved rail is preferably made from manganese steel of ordinary composition containing iron, manganese, carbon, silicon and a small percentage of the ordinary impurities, such as phosphorus, sulfur and arsenic, or, if desired, the steel may contain commercial alloys such as chromium, tungsten, titanium, vanadium, nickel or copper; and is rolled from an ingot of standard size, preferably from an ingot of about six feet in length and having a section greater than twelve inches square, which will produce two or more rails of standard length and of standard section that will be formed entirely of thoroughly worked and wrought metal. My improved rail possesses a strong unbroken outer surface or skin and an extremely fine and uniform crystalline structure which is continuous throughout the rail, and it is free from segregations and other inequalities of composition. It is also free from defects, found in cast manganese steel rails arising from shrinkage, slag, gas and sand, or, from defects found in imperfectly heated and worked steel arising from cracks, slag blow holes or pipes. The rail also possesses great elasticity, toughness, tensile strength and shock resistance.

As an example of one method whereby my improved rail may be produced the ingot or bloom of manganese steel is first heated to, or brought from the molds at, a temperature above the point where the metal begins to weaken and which point I term the upper critical point, for example, from 1010 C. to 1050 C., and below the freezing point of the metal at 1330 C., preferably below the point at about 1250 C. where the metal becomes very fragile and brittle. Preferably the ingot or bloom is at a temperature from 1100 C. to 1230 C., depending on the character or analysis of the metal, the size of the ingot and the shape and section of the rail to be rolled, and at a temperature where the interior of the ingot or bloom is in a uniform, plastic state and the ingot as a whole substantially in a state of homogeneous solid solution. The skin or outer surface of the ingot or bloom, in case it is above the temperature of the interior, is then preferably reduced to a temperature at or below that of the interior and the ingot or bloom is then subjected to the action of the rolls. Preferably the first passes through the rolls are slight and without substantial reduction of the ingot or bloom in order to work the outer surface of the bloom and reduce the same to the condition of wrought metal, but after the initial passes the ingot or bloom is reduced rapidly or slowly as desired to its finished shape. Immediately thereafter, and while the metal is still hot from the heat of rolling and without reheating, the rail or finished shape is quenched, preferably in water.

The lowering of the temperature of the outer surface or skin while the interior is at a temperature above the upper critical point, and the initial passes through the rolls both tend to compress the metal of the ingot or bloom and provide the finished shape with a strong, tough and unbroken outer surface or skin.

The subsequent rolling of the ingot or bloom to its finished shape reduces the metal to a thoroughly worked or wrought condition throughout. By quenching immediately after rolling and without reheating, the full effect of the compression and working and consequent density is retained in addition to the results obtained by quenching so that the rail or finished shape possesses a stronger outer surface or skin and a finer crystallization than that obtained in the cast rail or that obtained in a rolled rail which is reheated prior to quenching. If the rail is reheated prior to quenching the outer surface or skin may be oxidized or cracked and thereby weakened so that it will have less abrasive resistance and the rail is more liable to be broken by shock or stress than if quenched directly from the heat of rolling. Furthermore, the crystalline structure will be much coarser, and more irregular, especially if after rolling the rail at temperatures below the upper critical point it is slowly reheated before quenching.

What I claim is:

1. As a new article of manufacture a finished rolled manganese steel railroad rail possessing the structural characteristics of the metal as it leaves the rolls, substantially as described.

2. A rolled manganese steel railroad rail possessing the density, high elastic limit and fine crystalline structure characteristic of thoroughly worked metal and the toughness and hardness characteristic of quenched manganese steel.

3. A rolled manganese steel railroad rail consisting of thoroughly worked metal throughout and having a strong, tough unbroken outer skin.

4. A rolled manganese steel railroad rail consisting of thoroughly worked metal and having a continuous fine crystallization throughout.

5. A rolled manganese steel railroad rail consisting of thoroughly worked metal having a continuous fine crystallization throughout and having a strong unbroken outer skin.

6. A rolled manganese steel railroad rail of standard length and section consisting of thoroughly worked metal and possessing a continuous uniform fine crystallization throughout.

7. A rolled manganese steel railroad rail of standard length and section, quenched in water from the heat of rolling.

8. A railroad rail rolled from an ingot or bloom of manganese steel while its interior is heated to a temperature above the upper critical point, said rail having a continuous uniform fine crystallization throughout.

9. A railroad rail rolled from a manganese steel ingot or bloom of standard size heated to a temperature above its upper critical point, said rail being of standard size and section and consisting of thoroughly worked and wrought metal, having a continuous fine crystallization throughout.

10. A railroad rail rolled from a manganese steel ingot or bloom of standard size heated to a temperature above its upper critical point and quenched from the heat of rolling without reheating, said rail being of standard length and section and consisting of thoroughly worked metal of a continuous uniformly fine crystallization and having a strong unbroken outer skin.

11. A railroad rail rolled from an ingot or bloom of manganese steel while at a temperature above its upper critical point and having its interior in a soft and plastic condition, said rail consisting of thoroughly worked and wrought metal throughout.

12. A railroad rail rolled from an ingot or bloom of manganese steel heated to a temperature above its upper critical point and having its interior in a soft and plastic condition, said rail consisting of thoroughly worked and wrought metal throughout quenched from the heat of rolling without reheating.

This specification signed and witnessed this 25th day of September A. D., 1908.

WINFIELD S. POTTER.

Signed in the presence of—

Garret Van Cleve,

Oakley W. Cooke.