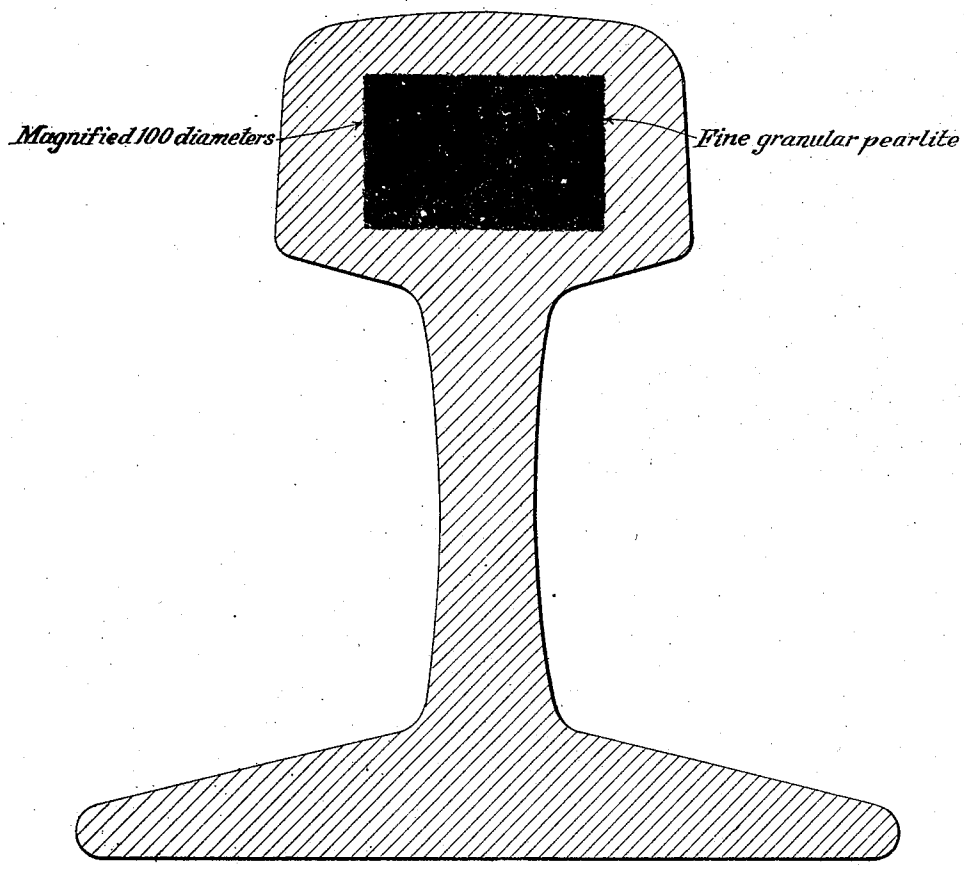
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STEEL RAIL.

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1,285,749. Patented Nov. 26, 1918.



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UNITED STATES PATENT OFFICE.

ROY A. LEWIS, WILLIAM ROBERT SHIMER, AND WILLIAM J. THOMAS, OF BETHLEHEM, PENNSYLVANIA, ASSIGNORS TO BETHLEHEM STEEL COMPANY, OF SOUTH BETHLEHEM, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

STEEL RAIL.

1,285,749. Specification of Letters Patent. Patented Nov. 26, 1918.

Application filed May 15, 1915. Serial No. 28,282.

To all whom it may concern:

Be it known that we, ROY A. LEWIS, WILLIAM ROBERT SHIMER, and WILLIAM J. THOMAS, all citizens of the United States, and residents of Bethlehem, Northampton county, Pennsylvania, have jointly invented new and useful Improvements in Steel Rails, of which the following is a specification, reference being had to the accompanying drawings, in which—

The figure of the drawing shows a section of a rail illustrating the microstructure of a rail embodying our invention, magnified 100 diameters.

Our invention relates to steel rails, and consists particularly in a rail containing less than .90% carbon, 1.00% manganese, and with silicon, sulfur and phosphorus in the percentages usually found in open hearth rail steel, and having a high tensile strength, a high elastic limit, an elongation, a reduction in area, and a hardness under the Brinell tests much greater than is found in an untreated rail of the same composition.

Typical examples of rails embodying our invention, containing, (1) .61% carbon, .68% manganese; (2) .71% carbon, .76% manganese, and with silicon, sulfur and phosphorus in the percentages usually found in rail steel, treated in accordance with our invention, have given the following results in comparison with untreated rails of the same composition:

(1.) *.61% carbon, .68% manganese.*

	Treated.	Untreated.
Tensile strength per sq. in.	130,000 lbs.	107,500 lbs.
Elastic limit per sq. in.	80,000 "	54,000 "
Elongation	17.5%	15.0 %
Reduction in area	43.3%	24.08%
Brinell hardness No	245	214

(2.) *.71% carbon, .76% manganese.*

	Treated.	Untreated.
Tensile strength per sq. in.	138,000 lbs.	120,000 lbs.
Elastic limit per sq. in.	88,000 "	66,000 "
Elongation	19.5%	13.5%
Reduction in area	48.8%	22.3%
Brinell hardness No	260	227

the treated steel showing the following increases over the untreated steel:

	Specimen No. 1.	Specimen No. 2.
Tensile strength per sq. in.	22,500 lbs.	18,000 lbs.
Elastic limit per sq. in.	26,000 "	22,000 "
Elongation	2.5 %	6 %
Reduction in area	19.22%	26.5%
Brinell hardness	51	23

In both instances the treated steel shows much greater strength and higher elastic limit, and is much more ductile, although considerably harder, than the untreated steel.

Untreated specimen No. 1, an 80-pound rail, supported on anvils spaced 3 feet apart, under a 2,000-pound weight, falling from a height of eighteen feet, stood four blows before breaking, and the total deflection, measured from the points of support, was 5.90 inches, the total elongation (in six inches taken along the exterior of the deflected portion of the rail) was 1.31 inches, and the fracture was coarse and crystalline.

Treated specimen No. 1, of the same section and mounted in the same way as the untreated specimen, stood six blows before breaking, with a total deflection of 8 inches, and a total elongation (in six inches taken along the exterior of the deflected portion of the rail) of 1.77 inches. The fracture was fine and fibrous.

Untreated specimen No. 2, a 100-pound rail, supported on anvils spaced 3 feet apart, under a 2,000-pound weight, falling from a height of twenty-three feet, stood four blows before breaking, and the total deflection, measured from the points of support, was 7 inches, the total elongation (in six inches taken along the exterior of the deflected portion of the rail) was .71 inches, and the fracture was coarse and crystalline.

Treated specimen No. 2, of the same section and mounted in the same way as the untreated specimen, stood seven blows without breaking, further blows being impossible on account of the limitation of testing

machine, the total deflection was 11 inches, and a total elongation (in six inches taken along the exterior of the deflected portion of the rail) of 1.06 inches. It was subsequently fractured and the fracture was found to be fine and fibrous.

We prefer to produce a rail having the characteristics above described, by taking a rail as it comes from the finishing rolls and the hot saw, cooling it in an air spray to a temperature well below the critical point, and thereafter re-heating the rail to a temperature above the critical point, and preferably between 1400° and 1500° F. When the rail has been heated so that all of its parts are of uniform temperature, we then remove it from the furnace and introduce it into a bath of oil or other cooling medium, so as to cool it very quickly, and thereby preserve as much as is possible the solid solution of iron and carbon in which condition the rail is when heated to above the calescence point. The rail is cooled to between 500° and 1000° F., and is then introduced into an annealing furnace, in which it is heated to between 1000° and 1250° F., and is retained in the annealing furnace until all of its parts have reached a uniform temperature. It is then withdrawn and allowed to cool.

The completed rail has a microstructure of fine, granular pearlite and is almost free from free ferrite. The free ferrite found in the rail is uniformly disseminated in small particles throughout its section, as is shown in the figure of the drawings. It contains between .60%–.90% carbon, .50%–1.00% manganese, and sulfur, silicon and phosphorus in the percentages usually contained in rail steel. It has a tensile strength of approximately between 115,000–155,000 lbs. per square inch; an elastic limit of approximately between 70,000 and 95,000 lbs. per square inch; an elongation of approximately between 15%–25% (in 2 inches); a reduction in area of approximately between 30%–55%, and a hardness by the Brinell test of approximately between 225 and 325.

Rails made in accordance with our invention are found not only to have a greater tensile strength and elastic limit than untreated rails of the same composition, but they also have a much greater ductility and hardness, thus greatly increasing the life of the rail when made in accordance with our invention.

The terms and expressions which we have employed are used as terms of description and not of limitation, and we have no intention, in the use of such terms and expressions, of excluding any equivalent for the features which we have described, but recognize that various modifications are possible within the scope of the invention claimed.

What we claim is:

1. A steel rail having a microstructure of fine granular pearlite, and being almost free from free ferrite, containing approximately between .60% to .90% carbon, .50% to 1.00% manganese, and with sulfur, silicon and phosphorus in the usual percentages found in open hearth rail steel, and having a tensile strength of over 115,000 lbs. per square inch, an elastic limit of over 70,000 lbs. per square inch, an elongation of over 15%, a reduction in area of over 30%, and a hardness by the Brinell test of over 225.

2. A steel rail containing approximately between .60%–.90% carbon, .50%–1.00% manganese, and sulfur, silicon and phosphorus in the usual percentages found in open hearth rail steel, and having a tensile strength of approximately between 115,000 and 155,000 lbs. per square inch, an elastic limit of approximately between 70,000 and 95,000 lbs. per square inch, an elongation of approximately between 15% and 25%, a reduction in area of approximately between 30% and 55%, and a hardness by the Brinell test of approximately between 225 and 325.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."