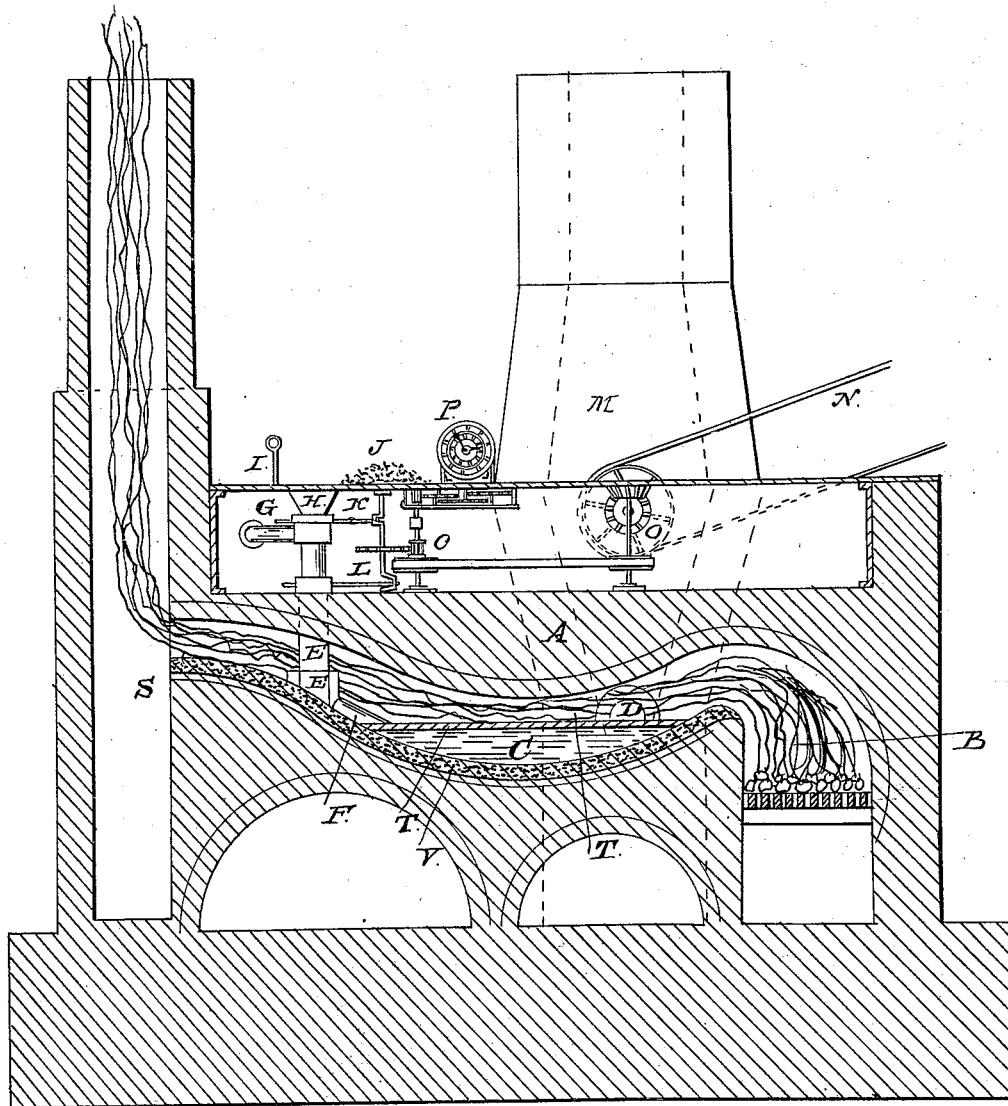


W. GERHARDT.  
 Manufacture of Iron and Steel.

No. 52,560.

Patented Feb. 13, 1866.



WITNESSES  
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# UNITED STATES PATENT OFFICE.

WILLIAM GERHARDT, OF PITTSBURG, PENNSYLVANIA.

## IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. 52,560, dated February 13, 1866.

*To all whom it may concern:*

Be it known that I, WILLIAM GERHARDT, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Process for the Manufacture of Iron or Steel; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The drawings represent one of the furnaces and apparatus in which my process can be carried out, seen in sectional elevation through the longitudinal center of the furnace.

My invention consists in an improved process for producing puddled steel and wrought-iron by injecting oxide of iron ore and purifying substances, by means of a blast of air, into the melted pig-iron while the same is heated in a suitable furnace, in the manner below more fully specified.

To enable others skilled in the art to make and use my invention, I will proceed to describe its operation and the apparatus in which I can carry it out.

A is the puddling-furnace; B is the fire-space. V is the furnace hearth or bed. C is the cast-iron in a molten condition ready to be puddled. D is the opening through which the melted pig-iron is introduced. M is the blast-furnace in which the pig-iron is melted. E is the blast-pipe, made of clay, plumbago, or any other suitable material. F is the cast-iron pipe for the supply of the blast, through which the oxide of iron, the iron ore, or other purifying agents are introduced. G is the pipe through which the blast arrives from the blowers. H is the funnel-shaped box into which the oxide of iron, iron ore, or other substance is introduced and measured. I is the scraper for pushing the oxide of iron or other substances into the hopper H and scraping it level, so as to make an accurate measurement. J is the oxide of iron, iron ore, or other chemical agents to be introduced into the blast. K is the top valve. L is the bottom valve. O is the machinery, moved by the belt N, for opening and shutting, alternately, the valves K and L. P is the counting and registering apparatus. S is the chimney; and T T is the slag or cover-

ing of vitrified substance to protect at pleasure the molten cast-iron from the contact with the flame of the furnace.

The above-described apparatus will answer to carry out my process; but many modifications can be made, and other forms of apparatus can be employed, the three essential points required being, first, a furnace where the pig-iron is melted; second, a furnace where it is submitted to the treatment hereinafter described; and, third, an apparatus for introducing, by blast of air, the chemicals required for my process directly into the mass of the molten iron, and keep a record of the amount of chemicals there introduced.

The pig-iron being melted in the blast-furnace M, a determined quantity is run, by the opening D, into the furnace A, the slag T T is thrown onto it, and the machinery is put in motion, and the hopper H being kept supplied, the chemicals are injected by the blast-pipe E into the mass of molten cast-iron C.

The chemicals are varied according to the result which is aimed at and to the quality of the cast-iron which is used.

If wrought-iron is to be made, oxide of iron, iron ore, and purifying agents are introduced, either singly or mixed in the proportions which experience will demonstrate to be the best adapted to the quality of the cast-iron employed. If steel is to be produced, oxide of iron, iron ore, and purifying agents are introduced, but in different proportions, and carbonizing agents are next introduced, or all the substances are mixed in proper proportions and introduced at the same time.

The advantages derived from my process are the following:

First, by treating cast-iron when run directly from a blast, cupola, or air furnace I save the time now used in melting the pig-iron in the puddling-furnace before the puddling itself takes place.

Second, by introducing by blast the oxide of iron, iron ore, and purifying agents under the surface of the molten cast-iron I cause a rapid decarbonization of that cast-iron in a manner more perfect than in the ordinary process of puddling, where only the surface of the pig-iron comes in contact with the atmospheric air.

Third, by the perfect adjustment of the quantity of oxide of iron, iron ore, or other chemicals introduced into the melted cast-iron the quicker or slower decarbonization, and thereby the resulting quality of steel or wrought-iron, can be regulated.

Fourth, by controlling the introduction of pure oxygen into the mass of molten iron by the injection of oxide of iron, iron ore, and other chemicals containing no sulphur I can at pleasure cause a complete or a partial decarbonization of the cast-iron entirely under the slag, and without letting the metal come in contact with the sulphurous flame of the furnace, and obtain thereby a finer quality of steel or iron.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. Running the melted pig-iron from a blast-furnace, cupola, or air-furnace, directly or by

shank into the puddling-furnace, for treating it in the manner specified.

2. Injecting by blast of air directly into and under the surface of molten iron in a puddling oxide of iron, iron ore, or carbonizing or purifying agents, in the manner and for the purpose specified.

3. Gaging and recording the introduction of oxide of iron, iron ore, and other chemical agents introduced by blast of air into the molten iron, as specified.

4. Operating at pleasure the partial or total decarbonization of cast-iron under the slag by the injection, by blast of air, of oxide of iron, iron ore, and purifying agents, without letting the iron come in contact with the sulphurous flame of the furnace, in the manner specified.

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Witnesses:

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