

# United States Patent Office.

JOHN D. GREY, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO HIMSELF  
AND JOHN LIPPINCOTT, OF SAME PLACE.

*Letters Patent No. 103,323, dated May 24, 1870; antedated May 7, 1870.*

## IMPROVEMENT IN THE MANUFACTURE OF SHEET-IRON.

The Schedule referred to in these Letters Patent and making part of the same

*To all whom it may concern:*

Be it known that I, JOHN D. GREY, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and improved Mode of Manufacturing Polished Sheet-Iron; and I do hereby declare that the following is a full, clear, and exact description thereof.

After the iron is rolled into sheets, as ordinarily practiced in rolling-mills, I take the sheets, without previously annealing them, and the first process toward converting them into polished iron is to remove the scale formed upon the surface of the iron during the process of rolling them from the bars or slabs.

The first scale formed upon the iron is of a short, brittle nature, and will easily leave the iron when it is bent back and forth, and expose the white or pure iron underneath.

It is practicable to polish the surface of sheet-iron with the original scale on, but it would be of no commercial value for the various uses in the arts to which the genuine Russia iron is applied, on account of the objectionable feature referred to above, viz., the tendency of the scale flying off or leaving the iron when it is bent back and forth.

By my process, I remove the scale in a different manner from any heretofore practiced for the purpose of making a polished sheet iron, and proceed as follows:

A wooden tank lined with sheet-lead, or other suitable material, of sufficient capacity and dimensions to admit of dipping the sheets into a bath of water and muriatic acid, with which the tank is filled, in about the proportion of five parts of water to one part of acid; after a short time, a minute or so, the sheets are removed from the bath and placed upon their edges to drain, after which they are placed upon their edges, resting or supported by means of a rack placed on the bottom of a reverberatory or other furnace having a dead, clear heat, free from flame or smoke; as the sheets of iron become red-hot, the scale will commence to raise in large blisters from both sides of each sheet at once; the rack, or the pins in the rack, having a space of four or five inches between them, so that the heat in the furnace will affect all the sheets alike.

As soon as the blisters commence to raise they will spread all over the sheet until the entire scale has left the iron. The sheets are removed at this stage of the operation from the furnace, when they are swept clean with a broom provided for the purpose.

A remarkable change now takes place upon the surface of the iron, which I regard as an important feature of my improvement, namely, the formation of the thin oxide covering of a uniform thickness upon the

protects the iron from rusting when polished, as hereinafter described.

This oxide is peculiar in itself, owing to the tenacity with which it adheres to the iron; it has no disposition to leave the iron when the sheet is bent back and forth.

This oxide, or thin scale described by me, is formed upon the iron instantly on its removal from the furnace or heating medium while red-hot, or sufficiently hot to cause oxidation when exposed to the outside atmosphere.

While the iron is being heated in the furnace to the necessary degree to raise the scale in the manner heretofore described, the old scale protects the inner surface of the sheets, excluding the atmosphere up to the moment of their withdrawal from the furnace, when the old scale is instantly cooled and leaves the surface of the iron in large flakes, exposing the inner red-hot and perfectly clean iron to receive the new oxide covering; as soon as the atmosphere strikes it the iron rapidly cools and presents a very uniform blue shade upon both sides of the sheet.

When the scale has been removed by the common method, which is by pickling in acid, the latter penetrates the pores of the iron and will remain in it, causing the iron to rust in spite of all that can be done to prevent it. But when the scale has been removed as described by me, in a furnace, it will not rust after being polished, and I prefer it on this account.

Bars or slabs of iron may be treated by my process in the manner substantially as I have described.

The thin oxide covering will prevent the bars or slabs from rusting after they have been rolled to polish them, between suitable grooves or rolls that are highly polished for this purpose.

The operation of polishing the iron in sheets I accomplish in the following manner, viz:

By rolling the sheets in packs, cold, between sheet rolls such as are used in rolling-mills, with the exception that the rolls, instead of being turned slightly concave to allow for expansion caused by rolling the iron hot, are for my purposes turned perfectly flat, so as to bear equally and uniformly all over the pack of sheets while passing between the rolls.

I first pass the sheets singly between the rolls once or twice, to flatten them and to get the bearing of the rolls, care being taken to place the sheets after this upon each other, in packs of six or more, in the same relative position as when passed between the rolls, so that they will lie closely together, and preserve the same bearing in the pack that they had when rolled single.

The pack of sheets is then passed between the rolls, the pressure being applied gradually by the screw in



the housings, as ordinarily practiced in rolling hot iron. After several passes of the pack the polish caused by the pressure and friction between the sheets will begin to come, and the sheets will rapidly assume the desired degree of polish, except the two outside surfaces of the sheets next to the rolls.

The pack is now divided in the middle, and the two outside sheets with the surfaces that before were next to the rolls are placed in the middle facing each other. The pack is then again passed between the rolls, the necessary pressure applied, and a few passes will complete the pack; or the outside sheets of each pack may be finished in the next succeeding pack, if desired.

Rolling the iron cold in packs has a tendency to harden it and slightly elongate or draw it out, so that if the iron used at starting was No. 24, when finished it will be No. 26 or 27.

The iron is then annealed by heating in an open furnace, one sheet at a time, care being taken to not heat it beyond a cherry-red, as there is danger of injuring the polish as well as starting the scale if a too high heat is used. The iron can also be annealed in a close iron box placed in a furnace and heated up to the required temperature and cooled gradually, as is now practiced in most rolling-mills making common sheet-iron.

Rolling sheet-iron in packs cold, for the purpose of polishing the surface, I believe to be original with me, and it is a matter of the greatest importance, as the fine, delicate scale formed by the process heretofore described, upon the surface of the sheets, receives no injury when rolled in this way, and the presence of the fine scale upon the surface of the iron is necessary to protect the iron from injury by rust when exposed to a damp atmosphere.

The iron may be turned before or after it is annealed, preparatory to baling ready for market.

Sheet-iron that has had its scale removed by pickling in an acid and water bath, in the common manner, may be treated by my improved process, and a new thin scale formed upon it, as I have described.

Either chilled or soft rolls can be used in rolling the iron to polish it. If chilled rolls are used and are smooth, the surface of the iron when polished will be free from any indentation, but if soft rolls are used they become indented by use, and the polished sheet-iron produced by them will be correspondingly indented, and will present the same appearance as the genuine Russia iron in this respect.

Any desired marking may be imparted to the surface of the iron by rolling between rolls that have correspondent formations upon their surfaces.

Having thus described my invention,

What I claim as new, and desire to secure by Letters Patent, is—

1. Preparing sheet-iron for being polished, by removing the natural surface scale, and forming thereon a new and thin scale, as and for the purpose specified.

2. Rolling a number of cold sheets of iron in a common pack to produce a polish by their friction upon one another, rather than by pressure in the usual manner, all as set forth.

The above specification of my invention signed by me this 26th day of April, 1869.

JOHN D. GREY.

Witnesses:

JOHN LIPPINCOTT,  
JOS. M. LIPPINCOTT.