UNITED STATES PATENT OFFICE.

ISAAC E. CRAIG, OF CAMDEN, OHIO.

MANUFACTURE OF SHEET-IRON.

SPECIFICATION forming part of Letters Patent No. 379,371, dated March 13, 1888.

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To all whom it may concern:

Be it known that I, ISAAC E. CRAIG, a citizen of the United States, residing at Camden, in the county of Preble and State of Ohio, have invented a new and useful Improvement in the Manufacture of Sheet-Iron, of which the following is a specification.

My invention relates to an improvement in the manufacture of such sheet-iron and sheets of mild steel as are known in the market as "polished sheet-iron," "polished sheet-steel," &c; and the object of my invention is to provide an improved method of cleaning the sheets preparatory to finishing under the hammer. In doing this I adopt what is known as the "deoxidizing method," as distinguished from pickling, and which is now generally known to consist in deoxidizing the rough and coarse scale which the sheets bear on their surfaces after being drawn to gage, and leaving the metal of the scale adhering to the surface of the sheets as a thin coating of spongy iron. This has heretofore been done by interposing a layer of charcoal between each two of a large package of sheets and heating for a sufficient time and degree to effect the chemical change. It is, in part, to avoid the waste of time and labor in removing the charcoal powder from the sheets before hammering; in part, also, to avoid the necessary loss of the heat of the package in separating the sheets to cleanse them of the charcoal, and to avoid the pickling and warping of sheets while being so cleansed, and, still further, to avoid the many practical difficulties and irregularity of results heretofore attendant on attempts to deoxidize without the interposition of layers of carbon in the form of charcoal powder between the sheets, in which the object of this invention specifically consists.

To carry my invention into effect I prepare the sheets between rolls having their surfaces marked with close pits or indentations. These marks may be on the surfaces of the hot rolls used in reducing the sheets to gage, or, as I much prefer, on what are known in the art as "cold rolls," through which the sheets are passed singly while cold after being reduced to gage. The rolls I recommend and find best for this purpose are such as have a very mild chill. These I go over, after being turned and ground to a perfect fit, with hammers having small oval faces or points of a diameter of from one-eighth, or even as small as one-twentieth of an inch, up to three-sixteenths or one-quarter of an inch, making marks deep enough to be plainly felt by an ordinarily-sensitive finger, a greater depth doing no harm. Precision and regularity are of no importance; but the marks should not, as a rule, be to exceed their own diameter from each other. Between the rolls so marked, with the upper one well screwed down, I now pass the sheets after they have been well annealed. The pressure or screw on the rolls should be such as to raise marks or bumps on the sheet high enough to be perceptible to the touch, after which the sheets are ready for the deoxidizing operation. This I sometimes conduct in the ordinary annealing-box without having the joint between the bed-plate and cover luted or sealed up. Whatever the fuel used may be, I find it necessary to so regulate the influx of air as will at all times keep the flame in the chamber where the box is heated of a deoxidizing character, which condition with natural gas or manufactured gas I find to be evidenced by the chamber when viewed through an aperture in the door showing a general smoky or cloudy condition in all its parts. A full charge for an ordinary annealing-box will in this way in about thirty hours from the time of running the box into the chamber and firing in the ordinary manner of raising the heat be found to be perfectly deoxidized. All parts of the surface of each sheet will have been sufficiently exposed to the action of carbonaceous heated gas to produce the desired chemical change. The box and its contents should be allowed to cool in the chamber fifteen hours, and for a period of ten hours of this time, when either natural or artificial gas is used as the fuel, a small quantity should be allowed to continue flowing into the chamber, with the air spaces or openings all closed up with a packing of clay. When coal is the fuel used, the fire-chamber where the grate-bars are located should be kept well charged with bituminous coal and all access of air as perfectly as possible cut off both below and above the grate. When cooled and opened, the contents of the box are in suitable-sized packages, usually sixty to eighty sheets, reheated and hammered in the usual manner. This operation may also

be conducted with some success by charging a package of the marked sheets without interposing layers of charcoal or any other deoxidizing material between them into the ordinary reheating-furnace of sheet-rolling mills and maintaining at a high red, or more properly, yellow-red heat for a period of eight hours, taking care to so fire the furnace as to maintain the package at the proper heat without admission of free oxygen into the heating-chamber. This is best accomplished by the use of gas as fuel. At the end of eight hours the furnace should be allowed to somewhat cool down, when the package is ready to be withdrawn and worked under the hammer without cleaning or opening of sheets, except so far as to remove the loose wrapping of waste sheets, which I find it desirable to place over ends and edges before charging into the furnace; but the method which I prefer is to stack up the number of sixty to eighty sheets without any foreign matter between them, and, after wrapping their edges, as above stated, charge them into the heating-chamber of a furnace substantially such as is shown and described on pages fourteen and fifteen of the pamphlet entitled "The Manufacture of Russian Sheet Iron," by John Percy, and published by Henry Cary Baird, of Philadelphia, in the year 1871, and as also substantially shown and described in Letters Patent of the United States issued to Richard G. Wood August 31, 1886, No. 348,258. Then heat and maintain at a yellow-red heat for eight hours, more or less. I then allow the chamber and its contents to cool slightly through about one-half hour by cutting off access of air to the fuel-supply, whether coal or gas, withdraw the package, and after stripping off the wrappers and without opening up the sheets proceed to hammer in the usual manner. On account of the ease of keeping the flame of a deoxidizing character I prefer in this method, as in the others named, to use natural gas or manufactured gas coming from a generator such or similar to that used in the well-known Siemens-Martin or open-hearth process of making steel. When working under the hammer sheets so rolled and so deoxidized, I find in practice that the slight separation of their general surfaces by reason of the bumps or nodules on them allows of sufficient circulation of atmospheric air to properly color or reoxidize each surface by the time the hammering is completed.

I am fully aware that it has heretofore been practiced in obtaining the deoxidizing effect on the scale as a means of cleaning sheet-iron—first described in Letters Patent issued to me May 31, 1870, No. 103,557, and in numerous patents to others since that time—to subject the sheets to the action of deoxidizing-gases without the intervention of charcoal or other carbonaceous matter of solid form between the sheets; but in all such operations, when successful, the sheets have been separated by placing them on edge in frames or introducing between them some chemically inert and refractory material. I am also aware that partial deoxidation is claimed to have been accomplished when marked similarly to those herein described by the action of the carbon contained in the steel on the oxygen of the scale of the sheets while heated in a box from which all gases are entirely excluded which come from the combustion-chamber. To none of these said inventions do I make any claim; but it has never within my knowledge been practiced to obtain freedom of circulation for reducing or deoxidizing gases among or between sheets by first rolling their surfaces into such mottled or bumpy form as will limit their points of contact and form open passages between each pair of surfaces and then subjecting them to heat with access of deoxidizing gas or gases.

The advantages of this method have already been more particularly stated herein in naming the purposes and objects of the invention, and are, in a general way, increased ease and economy in the manufacture of polished sheets.

Having fully described my invention, what I desire to claim and secure by Letters Patent is—

An improvement in the manufacture of polished sheet-iron, consisting in a combination of the following steps: first, producing nodules or projections on the sheets by passing them between artificially-pitted rolls; second, exposing them in packs or piles without the interposition of other solid matter between them while hot to a circulation of heated deoxidizing-gas, and, third, polishing in the usual way.

ISAAC E. CRAIG.

Witnesses:
J. S. FORGY,
Y. A. SMITH.