

# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN PROCESSES OF MANUFACTURING IRON AND STEEL.

Specification forming part of Letters Patent No. **196,547**, dated October 30, 1877; application filed March 13, 1877.

*To all whom it may concern:*

Be it known that I, MOSHER A. SUTHERLAND, of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in the Process of Manufacturing Iron and Steel; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same.

The object of this invention is to produce either wrought-iron or steel, depending upon the length of time the treatment is continued, from good pig-iron, by the use of iron-scale and oxide of iron for a fix or fettling, and the application in a certain manner of a powdered mixture of manganese and carbon, with or without the addition of tin-scrap. By this method the quality of the product is better, the labor of puddling very much lessened, and the time and fuel required greatly diminished.

The following is a clear and exact description of my improvement, which will enable others skilled in the metallurgy of iron to put it into practice.

Any reverberatory furnace suitable for puddling iron may be employed. The iron-bottom furnaces commonly employed are preferable. The bottom of the furnace is lined with cinders and slags, as usual. Scales from the hammers and rollers are then thrown over them, and pulverized ores of oxides of iron, free from sulphur—preferably the magnetic oxides—are spread over these, and banked against the walls, so as to protect them, and at the same time form a shallow basin. Broken pigs or other forms of carbonized iron are placed in this basin, on the sole of the furnace. The weight of ore employed, for example, is about five hundred pounds, and the weight of pig-iron five hundred pounds. The fire having been started up, the iron becomes melted in about twenty-five to thirty minutes. Then two and a half pounds of a mixture of powdered oxide of manganese or pyrolusite and charcoal, in the proportion of one of the former to six of the latter, are thrown on the melted metal, and the whole stirred for about two minutes. Sixteen pounds of tin-plate scraps are next and immediately added. Then five pounds of the powdered mixture are added,

as before. Sixteen pounds of the tin scraps are then added, and followed by another charge of six pounds of the powder mixture. Between each of these charges the stirring occupies about two minutes. The iron at this stage shows what is technically termed "coming to nature." The operator now commences to change the heat to the deoxidizing flame, and to separate the tough mass into balls, which are taken to the shingling-hammer or squeezers and treated in the usual manner. From there they are taken immediately to the roughing-rollers, and thence, if desirable, to the merchant-train. The operation, from the commencement to completion, requires about one hour.

I have described the process as I prefer to practice it when the object is not specially to utilize waste tin-plate scraps. When this is the object, the scraps are added gradually until their weight may equal that of the charge of pig-iron. The addition of the mixture of powders should, in such cases, be increased correspondingly with the quantity added. When more than fifty pounds of the scraps are added they may be cut by suitable machinery into smaller chips, and added with a shovel.

The powdered manganese, oxide, and charcoal are sometimes placed in waste tin cans or boxes, and the whole thrown in, as previously described; or, as I prefer, they are mixed when dry, and, by means of a sieve, with a little grain flour, then dampened, and pressed into blocks of suitable weight for the purpose. These are dried, when they are easily handled, and without loss.

In the processes heretofore practiced it is required that the melted iron be constantly stirred or "rabbed," as it is termed, throughout the whole charge, the whole operation requiring not less than one and a half hour.

Tin-plate consists of the best quality of charcoal-iron coated or washed with tin. The scraps or cuttings, notwithstanding the various processes for their utilization, are largely a waste product, amounting to many tons each day in large manufacturing cities, and it is desirable to convert them into bar wrought-iron. The tin upon them in no way interferes with the quality of the iron, as it passes off at the neck of the furnace, or combines with the

scoria as an oxide. If desirable, the tin-plate scraps may be dispensed with entirely, and the process carried on, as specified, without them—that is, the mixture of manganese and charcoal, in the proportions already stated, is used in the same manner as if the tin scraps were not omitted, and the other steps of the treatment are pursued in like manner.

The advantages of this process are, first, in the superior quality of iron obtained; second, in the saving of about one-third the labor of puddling; third, the reduction of one-third of the time ordinarily required, and, consequently, of about that proportion of fuel, enabling the operator to turn out a correspondingly-increased number of batches per day; fourth, the working into the batch of waste tin-plate or other iron scraps when desired, and thereby converting them into a superior quality of merchantable wrought-iron.

I have stated that any suitable puddling-furnace may be employed. This also applies to fuel, as that of hydrocarbon oils or gases, in which cases the same comparative advantages would result as those I have specified where coals are employed.

Although I have so far referred only to the manufacture of wrought-iron in the specification, the process is applicable to the manufacture of steel, by arresting the process before the melted metal has assumed the pasty condition, and casting it into ingots while it is sufficiently liquid to be capable of being drawn

from the furnace. The period of the process when this is done will depend upon the quality of the steel it is desired to produce, whether of low or high grade, and must be learned by the experience of the operator.

Having thus described my improvements, what I desire to secure by Letters Patent of the United States, is—

1. In the process of treating pig-iron to form wrought-iron or steel, compounding therewith iron-scale, oxides of iron, and manganese, charcoal, and tin-scrap, substantially as specified.

2. In the process of treating pig-iron to form wrought-iron or steel, the combination therewith of iron-scale, oxides of iron and manganese, charcoal, and tin-scrap, substantially as set forth.

3. The process of decarbonizing pig-iron to form wrought-iron or steel, which consists in treating it on an open hearth and upon a bed of iron-scale and oxide of iron, with a compound of manganese oxide, carbon, and starchy material, substantially in the proportions and in the manner set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

MOSHER A. SUTHERLAND.

Witnesses:

A. M. SUTHERLAND,  
WM. L. MILLER.