

UNITED STATES PATENT OFFICE.

ZOHETH S. DURFEE, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. 122,312, dated January 2, 1872; antedated December 16, 1871.

I, ZOHETH S. DURFEE, of the city, county, and State of New York, have invented certain Improvements in the Pneumatic or Bessemer Process for Making Iron and Steel, and in the combination of the furnaces and converters connected therewith, of which the following is a specification:

In the manufacture of steel by the pneumatic or Bessemer process a great saving of fuel and iron, of wear and tear of furnaces, and of labor would be effected were it possible to make uniformly good products of the desired temper by converting the crude iron immediately it is tapped from the blast-furnace in which it is made. This plan has been and may still be practiced to a considerable extent; but it has been found that by reason of the irregular working of blast-furnaces, and the consequent varying character and quality of the crude iron produced, it was always very difficult and in most cases impossible to secure such uniformity in the converted metal as was essential to success in the business. Hence, at several establishments where the plan of taking the fluid iron as it was tapped from the blast-furnace and pouring it at once into the converter has been practiced, it has been abandoned, the proprietors preferring to incur the expense of handling and remelting the crude iron after it had been cast into pigs in order thus to secure the advantage of carefully selecting and mixing the materials for each charge to be converted. Now, in order to secure the greater portion of the saving due to taking the iron from the blast-furnace to the converter without its being allowed to cool and solidify, and at the same time to obviate the disadvantages resulting from the variations in the character and quality of the blast-furnace product, and in order also to be able to mix irons to any desired extent, I propose to place at any suitable points near the converting vessels—and by preference at such height as will permit the metal to be run into the converters from them without previously hoisting the ladles, into which the metal may first be tapped—reverberatory-furnaces, by preference gas-furnaces, into which furnaces the crude iron as it is brought from the blast-furnaces may be poured, and wherein it may be mixed with other irons and be so treated as to insure the metal from time to

time tapped out for conversion being as nearly as practicable of a uniform character. So many and so large furnaces may be used as the work in progress may demand; but in many cases one furnace of about double the capacity of the converter in use will be sufficient, as the necessary correction of the character of the crude iron can be very quickly made. Gas-furnaces offer especial advantages for this purpose, as they use much less fuel in maintaining a given temperature than do the ordinary reverberatory-furnaces, and can readily produce the highest heat required. After the iron from the blast-furnace has been poured into the reverberatory-furnace pig-iron of different qualities, or any metals or metalloids which it may be desired to mix therewith, may be introduced, and so, also, may any fluxes which may be useful. Some qualities or grades of crude iron cannot advantageously be used in the Bessemer process, because they do not contain sufficient quantities of heat-giving elements, such as carbon and silicum, and consequently work cold, and the steel produced from them chills so quickly that it cannot be tapped from the ladles. Now, with the use of gas-furnaces as herein proposed, such metals can be so highly heated before they shall be poured into the converter that the lack of heat-giving elements will be compensated, and as iron lacking such elements—chiefly the higher numbers of pig-iron—is sold at lower prices than those irons which contain them, reverberatory-furnaces may also, in many cases, be advantageously used when iron is to be remelted for conversion; and when in such cases it may be cheapest to use cupola-furnaces for melting the pigs I would place a reverberatory-furnace at some convenient point between the cupola-furnaces and the converters, and tap the iron from the cupolas into the reverberatory-furnaces, and from thence, after first giving it the desired character and temperature, into the converter. It will be understood that these reverberatory-furnaces will give all needed opportunity for testing the irons under treatment, and also superior facilities for remelting any ingots and scraps which require to be reconverted; and when reverberatory furnaces are used alone or in combination with cupola-furnaces arrangements may be made for hoisting

any metal, which, in consequence of derangements of the converters or any of the connected apparatus, may require to be poured from the converters before it is completely converted, and pouring it into the reverberatory-furnaces so that it may be prepared for being returned to the same converter from whence it was taken, if it shall have been repaired, or to some other which may be in order. In case gas-furnaces are thus used in connection with cupola-furnaces, the latter may be so constructed as that the waste gases therefrom may be taken off for working the reverberatory gas-furnaces.

What I claim as my invention is—

1. Combining converting-vessels with reverberatory-furnaces and blast or smelting furnaces in such wise as that the crude iron can be tapped and run or carried, raised, and poured from the blast-furnaces into the reverberatory-furnaces, and then, after being treated as may be desired, be tapped out and be run into converters, substantially as and for the purposes described and specified.

2. Combining converting-vessels with re-

verberatory-furnaces and cupola-furnaces, in such wise as that the metal melted in the cupola-furnaces can be run from thence into the reverberatory-furnaces, and from the latter to the converters, substantially as and for the purposes described and specified.

3. I claim the herein described modes of producing uniformity in the character of the iron to be converted by the pneumatic or Bessemer process.

4. I claim the plan herein-described of increasing the heat of metals to be converted by the pneumatic or Bessemer process.

5. I claim so combining the apparatus used in the conversion of crude iron by the pneumatic or Bessemer process that the metal under treatment in the converters can be poured out and transferred to a reverberatory-furnace, and then tapped back into the converters, substantially for the purposes specified.

ZOHETH S. DURFEE.

Witnesses:

WM. H. SEYMOUR,
JOHN L. SWIFT.

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