

UNITED STATES PATENT OFFICE.

ROBERT FORESTER MUSHET AND EDWARD MAXWELL MUSHET, OF CHELTENHAM, ENGLAND, ASSIGNORS TO THEMSELVES AND ZOHETH S. DURFEE, OF NEW YORK CITY.

IMPROVEMENT IN THE MANUFACTURE OF CAST-STEEL.

Specification forming part of Letters Patent No. 118,633, dated August 29, 1871.

To all whom it may concern:

Be it known that we, ROBERT FORESTER MUSHET and EDWARD MAXWELL MUSHET, both of Cheltenham, England, and subjects of the Queen of Great Britain, have invented certain Improvements in the Manufacture of Cast-Steel, of which the following is a specification:

When steel is melted in any open-hearth furnace, such, for instance, as the Siemens Martin gas-furnace, or any modification thereof, it is found necessary to add at the close of the operation a variable quantity of manganesic iron, called speigeleisen, or Franklinite iron, in order to steelify the metal and render the ingots cast from it ductile when forged or rolled. This speigeleisen is costly and also variable in quality, and to obviate either wholly or partially the expense of this material and the want of uniformity in the product which attends the addition of speigeleisen to melted cast-steel, as well as to improve the quality of the melted steel, is the object of our invention, and we proceed as follows to carry it into effect. When a quantity of steel has been melted in an open-hearth furnace, such as the Siemens regenerative gas-furnace, and shortly before the melted steel is ready to be tapped or run out, we add to the charge of melted steel a quantity of oxide of manganese, spreading and stirring the said oxide of manganese among the melted steel with an iron rake or rabble. The melted steel is then tapped and run off into molds in the usual manner. The oxide of manganese, which we prefer to employ, is the common cheap manganese of commerce, and we prefer to grind or pulverize it so as to reduce it to the state of a fine flour or powder. The quantity of oxide of manganese which we use is from one hundred to two hundred pounds avoirdupois, by weight, to five tons of melted steel; but these proportions may be varied. We prefer to introduce one-half the quantity of manganese employed twenty minutes before tapping off the melted steel from the furnace, and to introduce the residue of the oxide of manganese ten minutes before tapping; but we do not confine ourselves to these specific times. Our object, however, is to introduce the oxide of manganese so short a time before tapping the melted steel that the said oxide of manganese may not have time to injure the hearth

and lining of the melting-furnace, which its prolonged presence in the furnace would inevitably do. Our object also is to introduce the said oxide of manganese at such a period as may enable it to act upon the melted steel and effect therein the improvement of quality we desire; and we have found in practice that both these our objects are attained by introducing the oxide of manganese into the melted steel at about the times we have mentioned previously to tapping and running off the said melted steel—namely, one-half of the dose of manganese about twenty minutes before tapping, and the remainder of the dose about ten minutes before tapping. Nevertheless, the whole quantity of oxide of manganese may be added about twenty minutes, or about fifteen minutes, or about ten minutes before tapping. By the adoption of our process the employment of speigeleisen may in many cases be wholly dispensed with. In other cases only a very small dose will be required in addition to the oxide of manganese. When the melted steel is too soft and requires to be carbonized, this may be done by adding some pure melted hematite pig-iron, or other pure pig-iron, with the subsequent addition of the oxide of manganese in the manner we have hereinbefore described.

When cast-steel is produced by the Bessemer or pneumatic process we proceed as follows: When the blowing of a charge of metal of from three to six tons is completed the converting-vessel is turned on its side so that the blast can be stopped; we then introduce into the converter, in any convenient manner, from one to two hundred pounds of oxide of manganese, which we spread and stir upon the surface of the melted steel with an iron rake or rabble. In about ten minutes the oxide of manganese will have had its effect upon the charge of melted steel in the converter, which steel is then run off into molds in the usual manner; the longer, however, the melted steel can be left after the introduction of the oxide of manganese without risk of chilling the more complete will be the action of the said oxide of manganese upon the charge of melted steel. The melted steel may be carbonized as required by running in pure melted hematite or other pig-iron in place of speigeleisen and then adding oxide of manganese in the manner we

have described. Speigeleisen may also be added to the melted steel, though such addition forms no portion of our claim.

We therefore claim—

The introduction of a quantity of oxide of manganese in the manner we have described into melted steel, whether in a reverberatory or open-hearth gas-furnace, or in a Bessemer converter, near the close of the operation, shortly before the metal is tapped or run off, with the view of superseding wholly or in part the employment of speigeleisen as at present used in the

said furnaces, for improving the melted steel therein, and likewise for the purpose of effecting an improvement in the quality of the cast-steel produced.

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