

UNITED STATES PATENT OFFICE.

LOUIS LA BRECHE-VIGER, OF MONTREAL, CANADA.

IMPROVEMENT IN CONVERTING ARTICLES MADE OF WROUGHT-IRON INTO STEEL.

Specification forming part of Letters Patent No. 121,263, dated November 28, 1871; antedated November 13, 1871.

To all whom it may concern:

Be it known that I, LOUIS LA BRECHE-VIGER, of Montreal, Province of Quebec, Dominion of Canada, have invented a new and useful improvement in the manufacture of axes, chisels, hammers, saws, augers, and of all other tools and instruments which are usually made of steel or of malleable iron, or partly of both, by welding, and also in the manufacture of rails, axles, and of all parts of machinery of any kind in which steel may be substituted for malleable iron, or may be usefully combined with malleable iron by welding; and I declare that the following is a full and exact description thereof.

The nature of my invention consists in manufacturing the articles to be treated under my process of and with wrought-iron first, and immersing them in a bath of molten cast-iron free from sulphur and phosphorus, and carburized to its utmost capacity. The best for that purpose is spiegleisen, but in default thereof, such cast-iron may be made by melting good malleable iron or blister-steel in a cupola-furnace with charcoal, or the best anthracite coal, or bituminous coal, or coke, as fuel. The articles are left in this bath a space of time which must vary with the degree of hardness desired to be imparted to the metal and with the size of the articles, and also according to the intention of converting the whole mass of the metal into steel, or simply of converting the surface so as to retain a core of malleable iron.

For small objects crucibles may be used, and for larger articles, or when large quantities are to be converted, reverberatory furnaces of all the descriptions now known may be employed.

After a number of operations the cast-iron bath would not be rich enough in carbon, and consequently the heat required to maintain it in a molten condition would be too high, which circumstance might cause the fusion of the parts sufficiently carburized before the underlying layers had attained to the proper degree of conversion; but to obviate this difficulty and retain to the cast-iron the required fluidity compatible with the lowest degree of heat, I line the crucibles and the bottom of the furnaces, which I build with silicious sand, with a brasque of charcoal-powder or of plumbago, into which I may incorporate nitrogenous matters, such as cyanides or animal matter, as leather or horn pulverized. This brasque is intended to supply to the bath

of cast-iron the carbon which may be abstracted from it by the metal during cementation, and also the nitrogen which may be useful to the metal; but it is not indispensable to the process, as the bath of cast-iron may be renewed after each operation by using fresh cast-iron, or by remelting the same in a cupola-furnace in contact with as pure fuel as possible, and running it directly from the cupola over the objects to be converted. The converting-bath of cast-iron may also be covered during the operation with a glass or slag covering, so as to prevent the loss of carbon by contact with the gas of the furnace. After remaining in the converting-bath the time required for the degree of conversion sought for the converted articles are taken out; or, still better, the cast-iron is tapped and run off, and the heat in the crucible or furnace increased so as to free the objects from any portion of cast-iron which might adhere to them, when it will be found that they are—according as the operation has been conducted—partly or totally converted into steel, the quality of which will depend upon that of the iron used.

I do not claim as my invention the principle of cementing malleable iron by immersion in molten cast-iron, as this was to a certain extent practiced anciently upon lumps of wrought-iron; but

I claim as my invention—

1. The cementation or conversion into steel of articles made of wrought-iron by immersing them in a bath of molten cast-iron after they have been partially worked into their respective shapes, whereby the heaviest parts of the work is accomplished upon wrought-iron and not upon steel, and the operation of welding steel to iron is dispensed with.

2. The cementation or conversion into steel of articles made of wrought-iron by immersing them in a bath of cast-iron in fusion in such a way as to convert only the surface of such articles to the required depth, leaving the interior in its original state of malleable iron, thereby producing articles externally as hard as those made of pure steel, with the toughness dependent on that part of their substance retaining the nature of malleable iron, and free from the inconvenience of imperfect welding.

3. The use of furnaces to effect such conversion on a large scale, as set forth.

4. The lining of crucibles or furnaces with a

brasque of pure carbonaceous matters and nitrogenous substances to keep the bath of cast-iron to its normal degree of carburization and to supply nitrogen to the steel.

5. Composing the bath of pure cast-iron necessary for such conversion by melting wrought-iron or blister-steel in a cupola-furnace with pure fuel, and recarburizing said bath by returning the cast-iron to said cupola-furnace whenever re-

quired, the whole as above described, and for the purposes set forth in the foregoing specification.

Montreal, May 3, 1871.

LOUIS LA BRECHE-VIGER.

Witnesses:

L. LAFLAMME,
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