

# UNITED STATES PATENT OFFICE.

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## ALLOY MANUFACTURE.

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Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, ROBERT B. CARNAHAN, Jr., a citizen of the United States, residing at Middletown, Butler county, Ohio, have invented certain new and useful Improvements in Alloy Manufacture, of which the following is a specification.

The present invention comprehends the manufacture of iron alloys, by which is meant alloys containing at least 80 per cent. of iron.

Notwithstanding the teachings of some authorities that pure iron is without utility in the arts, owing to its extreme susceptibility to corrosion, I have discovered that this is not correct. Having produced on a large scale what I believe to be the purest iron yet commercially produced, I have ascertained that the greater its purity the greater its resistance to corrosion and the greater its capacity for all of the general useful purposes of iron.

My present invention has to do with the process of manufacturing iron alloys, as above defined, the iron forming the base of the alloy being of extremely high purity, and the alloying metal or alloying metals being of a character to enhance the qualities of the iron as, for instance, by increasing the corrosion-resisting quality over that of the iron, or by increasing the strength over that of the iron, or both. The improved process may be executed with economy and certainty.

In executing my improved process I employ a basic open-hearth furnace which I charge with iron and purifying agents such, for instance, as lime and iron ore, the charge being then subjected to the action of an oxidizing flame at such high temperature and for such long continued period that the carbon and manganese will be practically eliminated, by which I mean that the carbon and manganese taken together will not be over .10 per cent., neither alone being, preferably, over .06 per cent. This process of elimination incidentally brings down the silicon, sulfur and phosphorus, and in practice the silicon, sulfur, phosphorus, carbon, and manganese need not exceed .14 per cent. when taken in the aggregate, and generally will not be half such percentage. The re-

sult of the process, thus far, is that the metal is highly super-oxidized, or burned past present utility. The super-oxidized iron may now be tapped out into a ladle and deoxidized and degasified by treatment with, say, aluminum, at the rate of two and one-half pounds per ton. The alloying metal or metals may be introduced into the ladle along with the iron to produce the alloy, but whatever may have been the degree of deoxidation of the iron, there must be a subsequent deoxidizing and degasifying action on the alloy. The general deoxidation may be facilitated and economized by charging pig-iron, say, at the rate of about one hundred pounds per ton, while the metal is in the furnace, and the alloying metal or alloying metals, instead of being combined with the iron after the iron has been withdrawn from the furnace, may be combined with the iron while in the furnace, either before or after the purification and the deoxidizing of the charge. In many cases the combining of the alloying metal or metals with the charge while in the furnace is decidedly preferable, as it avoids the cooling effect of the alloying metal or metals in the ladle. The alloy may be poured into ingots or other molds.

The alloying metal employed with the iron will be selected according to the special desire regarding the alloy, a nickel-iron alloy, for instance, being of particularly high value in resisting corrosion, and the alloy having greater strength than the unalloyed iron. The alloys resulting from the improved process have distinct advantages in the art by reason of the high purity of the iron forming their bases.

The deoxidation of the alloy, or the deoxidation of the iron plus the deoxidation of the alloy, can, without difficulty, be carried to such extent that the oxygen does not exceed .05 per cent. or even to half this amount, and as known methods of determining oxygen content vary in their results, reference is here made to the Ledebur method of oxygen determination as a 100 standard.

I claim:—

The improved process for producing carbonless, manganeseless pure iron alloys,

which consists in eliminating practically all of the carbon and manganese from the iron by the action of purifying agents and an oxidizing flame under basic conditions; combining therewith an alloying metal or alloying metals; deoxidizing and degasifying the alloy while in molten form; and pour-

ing the alloy into molds, the alloying metal or alloying metals not to exceed 20 per cent. of the whole, substantially as set forth.

ROBERT B. CARNAHAN, JR.

Witnesses:

LUTIE HALE,

GEO. JOHNSON.