

UNITED STATES PATENT OFFICE.

JULIUS BAUR, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN THE MANUFACTURE OF STEEL.

Specification forming part of Letters Patent No. 47,510, dated May 2, 1865.

To all whom it may concern:

Be it known that I, JULIUS BAUR, of the city, county, and State of New York, have invented a new and useful Improvement in the Manufacture of Steel; and I hereby declare that the following is a full, clear, and exact description of the same.

I have discovered that when a small quantity of aluminium is combined with iron or steel the quality of the latter is greatly improved, and they are rendered tough, pliable, and capable of being made very hard; and my invention consists in effecting this combination in such a manner as to produce these results, or such a part of them as may be desired. Oxide of aluminium is found in a pure or nearly pure state, and may in this form be employed for the purpose; but, so far as I am at present aware, it exists in this condition only in small quantities, and is difficult and expensive to procure, and therefore, in putting my invention practically into use, I prefer to obtain it from cryolite and analogous substances which contain it, and which may be procured with suitable economy and in sufficient quantities.

My invention may be advantageously applied in making steel in the ordinary steel-makers' crucibles, and when thus used I have found it to be a successful manner of employing it to take the requisite quantity of cryolite or other aluminium-containing substance and cause it, by means of agents acting chemically, to be decomposed during the process of producing the steel, whereby the aluminium will be readily formed in a pure or nearly pure state, and will then combine with the iron placed in the crucible and produce the desired effect.

The iron which I use may be either wrought-iron, puddled iron, or ordinary pig-iron; and to enable others to practice my invention, I will describe it as I have applied it with success to the making of a superior steel from what is known as "Peru" iron taken in the wrought state.

For fifty pounds of Peru iron I employ five ounces of cryolite, three ounces of oxide of iron, two and one-half ounces of manganese, five ounces of vegetable charcoal, two ounces of animal charcoal, and one and one-half ounce of phosphate of lime. These materials I place together in a crucible of the ordinary construction, and apply heat, as usual. Cryolite is a fluoride of aluminium and a fluoride of sodium,

and as the iron in the crucible melts the fluorine in this fluoride of aluminium is removed by a part of the iron, or by some of the elements alloyed with the iron. This operation sets free the aluminium in the cryolite, which, in a pure or nearly pure state, combines with the iron, forming a ferride of aluminium, and at the same time the carbon, or most of it, unites with the iron, imparting to it the requisite steely properties, while the sodium contained in the cryolite acts to flux out or remove the silicious constituents of the iron, and the oxide of manganese and the phosphate of lime also operate to carry off impurities. I prefer to use animal charcoal with the vegetable charcoal, in order to obtain a small quantity of nitrogen, which is desirable for good steel. The product thus prepared I have tested and found to be a superior article for tool-steel. When, however, I desire to make a low steel suitable for springs and analogous purposes, I have successfully prepared it by taking Peru iron, as before, and varying the proportion of the oxide of iron employed, using six ounces of it, instead of three, as in the foregoing statement of ingredients, the other materials remaining as above given.

It will of course be understood that it is difficult, if not impossible, to state in a single specification the variations made necessary in the proportions of the ingredients which I employ, according to the differences in the constitution and quality of the iron used; but these variations do not affect the principle of my invention, and will be readily ascertained by those skilled in the art. I have already given the proportions which I prefer for one kind of iron taken as an illustration of my invention, and I may mention that for most kinds of wrought or puddled iron proportions within the following range will be found suitable—that is to say, for every fifty pounds of iron from one to five ounces of cryolite, from one to four ounces of oxide of iron, from one to three ounces of oxide of manganese, from one and one-half to two ounces of phosphate of lime, from one and one-half to five ounces of vegetable charcoal, and from one and one-half to five ounces of animal charcoal.

It is also proper to say that though I prefer to use the oxide of manganese and the phosphate of lime, because they improve the quality of the steel, which is the reason why I have mentioned them, they are not absolutely nec-

essary to my invention, and may be omitted; but if they are not used a poorer product will result. Neither is it essential that the carbon employed should be in the condition of vegetable or animal charcoal, as it may be introduced in any other suitable form.

All kinds of clay contain oxide of aluminium, and the mineral known as "diaspore" also contains it. The methods of treating these substances so as to reduce this oxide to metallic aluminium are well known, and, if desired, clay or diaspore may be employed to furnish aluminium, it being of course understood that the proportions of carbon and oxide of iron used in reducing the oxide of aluminium to

metallic aluminium are to be varied according to the amount of oxide of aluminium in the clay or diaspore; but this is well known to chemists, and need not be further detailed.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

The above-described process, consisting of combining aluminium with iron in the manufacture of steel, substantially as set forth.

JULIUS BAUR.

Witnesses:

C. L. TOPLIFF,

M. M. LIVINGSTON.