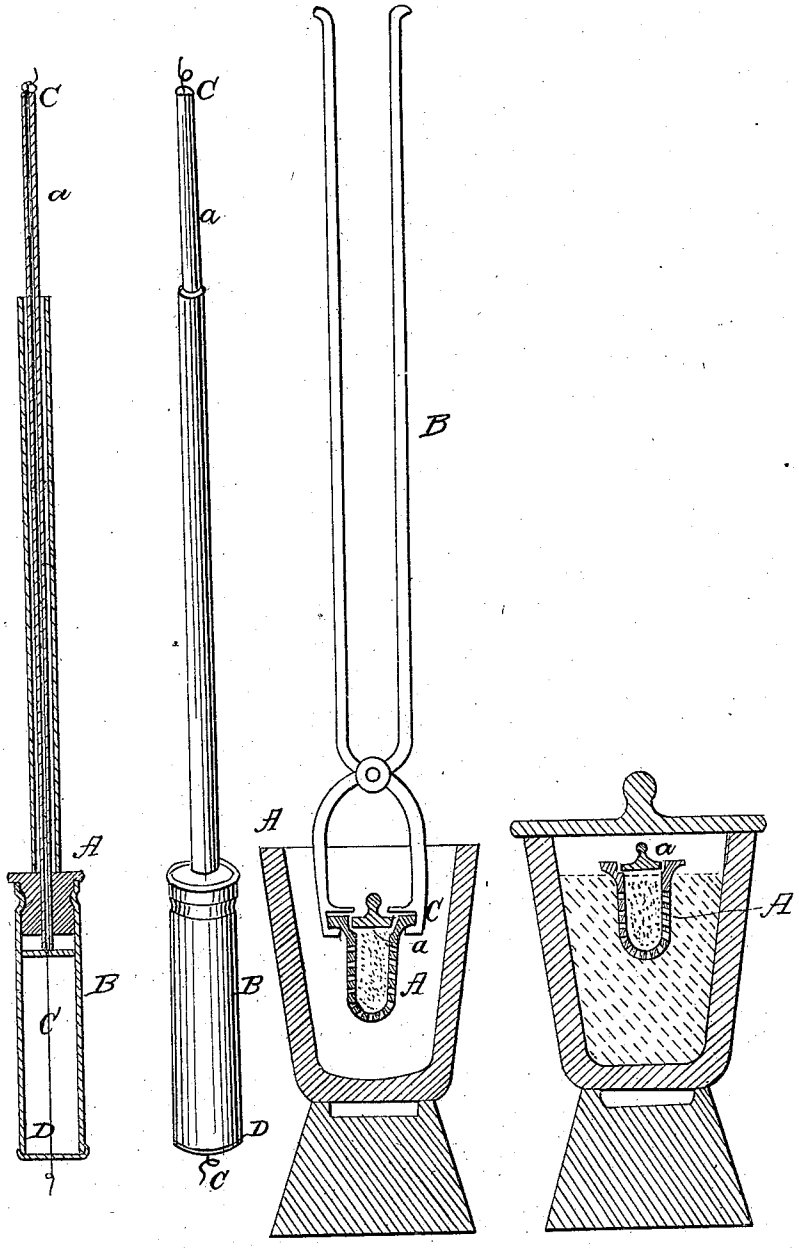
W. GERHARDT.

Refining Iron and Steel.

No. 40,472.

Patented Nov. 3, 1863.



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UNITED STATES PATENT OFFICE.

WILLIAM GERHARDT, OF NEW YORK, N. Y.

IMPROVEMENT IN PURIFYING IRON AND STEEL.

Specification forming part of Letters Patent No. 40,472, dated November 3, 1863.

To all whom it may concern:

Be it known that I, WILLIAM GERHARDT, of the city, county, and State of New York, have invented a new and useful Improvement in the Manufacture of Steel and Iron; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to letters of reference marked thereon.

The nature of my invention consists in a peculiar method of introducing oxides of iron or other solid substances containing oxygen into molten iron for the purpose of decarbonizing the same, in order to strengthen it or to reduce it to cast-steel or wrought-iron, in the manner here below fully specified.

The advantages that results from the use of my improvements are manifold. As it is very important to obtain cast-iron of great strength and close texture, many means have been resorted to to increase the compactness and resistance of the same. The most successful of all devices invented for this purpose—that of abstracting carbon by injection of air—requires complicated arrangements, and consequently great outlay. At the same time this process is not without danger, involving considerable loss, and it can therefore only be conducted by men of intelligence. In my process I accomplish the same result—the partial decarbonization of the cast-iron—in much less time, with a mere nominal expense, without danger, and with a precision that none of the known processes can offer. The amount of carbon that has to be oxidized in order to obtain iron of a certain strength can previously be ascertained, and the corresponding quantity of oxygen present, in exact calculated proportions in the oxides, subsequently added, as claimed in my improvement, introduced. When, further, my process is applied to steel, the same can be rendered softer, even during the last heating moments in the crucible, because the reducing material, as well as that to be reduced, can fully be controlled and calculated to a fraction—an advantage that has never before been obtained. It it well known to steel-melters that the plumbago-crucibles, when exposed to very intense heat, give off their carbon to the molten steel, and render thereby the intended soft steel too high. This is too highly carbonized, and therefore too short or brittle.

The comparatively trifling cost of the process, the facility with which it can be applied at any time, in small as well as large quantities, the absence of loss, and the perfect control of the product are advantages that every practical steel and iron manufacturer will freely admit.

Having described the most important advantages of my process, I will, to enable others skilled in the art to construct and use my improvements, describe the apparatus used in the same and the *modus operandi*.

Figure I of the annexed drawings shows one modification of the apparatus, which I prefer to use when I desire to produce a quick decarbonization of cast-iron or a softer modification of steel.

A is a short cylinder, in which the tube *a* can be slid up and down. This inner tube contains a wire, C, on the lower end of which is attached a cup or cover, E, supporting the sheet-iron cylinder B, which closes around A. Between the cover E and the sliding cap D, I place the oxide of iron or other decarbonizing substance, and, holding up the upper part of the wire C, I dip the sheet-iron tube B into the crucible or other vessel containing the molten metal. When the lower wire, cap, and tube have burned away, I push the oxidizing material contained in the tube slowly down until all of it shall have been expelled, when the tube is withdrawn.

If the iron or steel to be decarbonized contains sulphur or other impurities, I mix with the oxides such substance or substances as can combine with the same, pass off as vapor, or unite with the covering flux. For instance, if a small portion of chloride of sodium or calcium or lime, or any other substance having the desired properties, be mixed with the oxides, the chlorine will abstract the sulphur, pass off partially as chloride of sulphur, while the rest will be kept by the flux covering the steel or iron. It is of the highest importance to free steel and iron from sulphur. The most intimate contact with the material that should act upon it is required. This can only be accomplished by such means as I have adopted in my process.

The other modification, to be used when a slower oxidation is desirable, is shown in Fig. II of the drawings. It consists in the vessel A, covered with a lid, *a*, of convenient shape and size, constructed of fire-clay, magnesia, or

other fire-proof material, which, however, must be free from any carbonaceous substance, such as plumbago, coke, &c. This vessel or crucible is pierced with numerous holes, and is attached to a handle, B, by the clamp or ring C. This vessel is filled with black oxide of manganese, oxide of iron, or other solid substance containing oxygen, and then placed into the crucible or vessel containing the steel or cast-iron, detached, and the handle withdrawn. The lid of the steel crucible or cover of the vessel will hold the small vessel below the surface of the metal, allowing the slow escape of the oxygen through small holes into the steel or iron, whereby the gradual decarbonization is effected.

The advantage of this apparatus consists in using the pure oxygen-gas, keeping the remaining substance from coming in contact with the steel or iron.

It is understood that, as otherwise constructed apparatus may be used to accomplish the same purpose, I do not confine myself to the exact shape of one or the other of the modifications described, and illustrated in my drawings here attached. I have described these apparatus only as the way or means by which the most intimate contact of the respective materials can be obtained, as is required by the law of chemical affinity.

Having fully described my invention, I claim for me as new and desire to secure by Letters Patent—

The method herein fully described, and for the purposes specified.

WILLIAM GERHARDT.

In presence of—
N. DAVENPORT,
JAS. T. C. GOODFELLOW.