

# UNITED STATES PATENT OFFICE.

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## PROCESS OF MANUFACTURING STEEL.

SPECIFICATION forming part of Letters Patent No. 399,528, dated March 12, 1889.

Application filed September 26, 1888. Serial No. 286,430. (Specimens.)

*To all whom it may concern:*

Be it known that I, ABRAHAM T. HAY, a citizen of the United States, residing at Burlington, in the county of Des Moines and State of Iowa, have invented certain new and useful Improvements in the Process of Manufacturing Steel; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention is directed to the manufacture of steel for structural purposes. For such steel a high degree of tenacity and elasticity is necessary, and by my invention I am enabled to obtain a product which uniformly meets these requirements.

My invention consists in a ferruginous alkaline sponge hereinafter described, adapted to be combined with the iron from which the desired quality of steel is to be produced.

In order to make my invention clearly understood, I will proceed to describe, by way of example, a practical means for carrying the same into effect.

By means of a suitable retort or furnace—such, for instance, as that described in my patent, No. 390,964, dated October 9, 1888—I produce a ferruginous alkalous sponge containing iron, calcium, aluminum, sodium, and chrome. To produce the same, I charge the furnace with a suitable stock, such as the following: iron oxide—such as Pilot Knob ore of Missouri—by weight, sixty-three (63) parts; coke, fifteen (15) parts; limestone—such as that of Joliet, Illinois—seven and one-half ( $7\frac{1}{2}$ ) parts; aluminous substance—such as scrap brick—four (4) parts; carbonate of soda, two (2) parts; bichromate of potash, three-fourths ( $\frac{3}{4}$ ) of one part; chrome, in an oxide,

one and one-quarter ( $1\frac{1}{4}$ ) part. This stock is fused, and, having been drawn off, forms the said sponge.

I may here remark, with regard to the proportions of the substances employed in the production of the sponge, that the relative amounts given above need not be rigidly adhered to. On the contrary, for the best results and greatest economy said proportions should be governed by the requirements arising from the composition of the crude-iron stock and from the particular uses to which the steel product is to be applied, whether for bridge members, railway-rails, axles, or other structural shapes.

I prefer to utilize the sponge or alloy by adding a suitable proportion—say from one to two and one-half per cent. in broken pieces—to the molten metal as the latter is poured from the converter into the ladle; or a portion of the sponge may be added to the metal in the converter at a time between the oxidation of the silicon and the oxidation of the carbon. I prefer this method when more than one per cent. of the sponge is employed, thus obtaining a thorough incorporation of the metals of the sponge with the molten iron and also avoiding lowering too much the temperature of the metal in the ladle.

Having thus described my invention, what I claim is—

A ferruginous sponge containing iron, calcium, aluminum, sodium, and chromium, substantially as set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

ABRAHAM T. HAY.

Witnesses:

J. S. BARKER,  
H. N. LOW.