

UNITED STATES PATENT OFFICE.

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MANUFACTURE OF IRON.

SPECIFICATION forming part of Letters Patent No. 399,611, dated March 12, 1889.

Application filed September 27, 1888. Serial No. 286,632. (No 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 Manufacture of Iron; 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 iron, which is to be used under conditions which subject it to a considerable degree of heat.

With changes of temperature the strength of iron varies; and it is the object of my invention, by regulating the composition of the iron, to secure a product which will be strong under all conditions, but particularly when raised in temperature, provided, of course, that a certain limit is not exceeded. Such an iron is especially desirable for fine boiler-plates and axles. Certain metals, when combined in a very small quantity (sometimes a mere trace) with iron, and which change their polarity relative to the iron with a certain increase of temperature, have the effect of materially increasing the strength of the iron at such higher temperature. These metals I term "pyro-electric," and among them may be enumerated nickel, cobalt, and copper.

My invention consists in a ferruginous alkaline sponge containing iron, an alkali, and one or more of the relatively pyro-electrical metals, and adapted to be combined with the crude iron which is to be manufactured into the desired shapes.

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 example, as that described in my patent, No. 390,946, dated October 9, 1888—I produce a ferruginous alkaline sponge containing iron, calcium, potassium, aluminium, and nickel.

To produce the sponge, I charge the furnace with a suitable stock, such as the following: Iron oxide—such as Pilot Knob ore, of Missouri—by weight, eighty-three (83) parts; limestone, nine (9) parts; crude potash, one and one-tenth (1.1) part; aluminous substance, as commercial alumina, corundum,

scrap brick or shale, or several of such substances, five and five-tenths (5.5) parts, and nickel, in an oxide, one and four-tenths (1.4) part. This stock is fused with a suitable fuel—such as coke—and, having been drawn off, forms the said semi-metallic sponge.

With regard to the proportions of the substances employed in the production of the sponge, I would remark that the relative quantities 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 product is to be applied. I therefore do not confine my invention to all of the particular substances and proportions given in the above example.

I prefer to use the sponge by adding a suitable proportion—say from one to three and one-half per cent. in broken pieces—to the iron in the puddling or knobbling furnace at the time when the iron is in a liquid state.

To still further increase the described quality of this iron product, I prefer to add to the sponge a trace of cobalt, which may conveniently and will generally be done by using an oxide of nickel which is combined with a cobalt oxide. A trace of copper also has a material effect in imparting the said quality to the iron product, and I prefer to add this element also to the sponge.

Iron *per se* is the same in all of the most celebrated as well as in the ordinary brands, the more valuable qualities of the former brands being due to the other metals with which the iron is combined or alloyed. By my invention I am enabled with the more ordinary and, as at present considered, less valuable brands to closely approach or equal the results obtained from the use of the most valuable and celebrated irons.

Having thus described my invention, what I claim is—

A ferruginous sponge containing iron, an alkali, and a metal isomorphous with iron and thermo-electric relative thereto, substantially as set forth.

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

ABRAHAM T. HAY.

Witnesses:

J. S. BARKER,

E. K. STURTEVANT.