

(No Model.)

A. T. HAY.

STACK FURNACE FOR REDUCING ORES.

No. 390,964.

Patented Oct. 9, 1888.

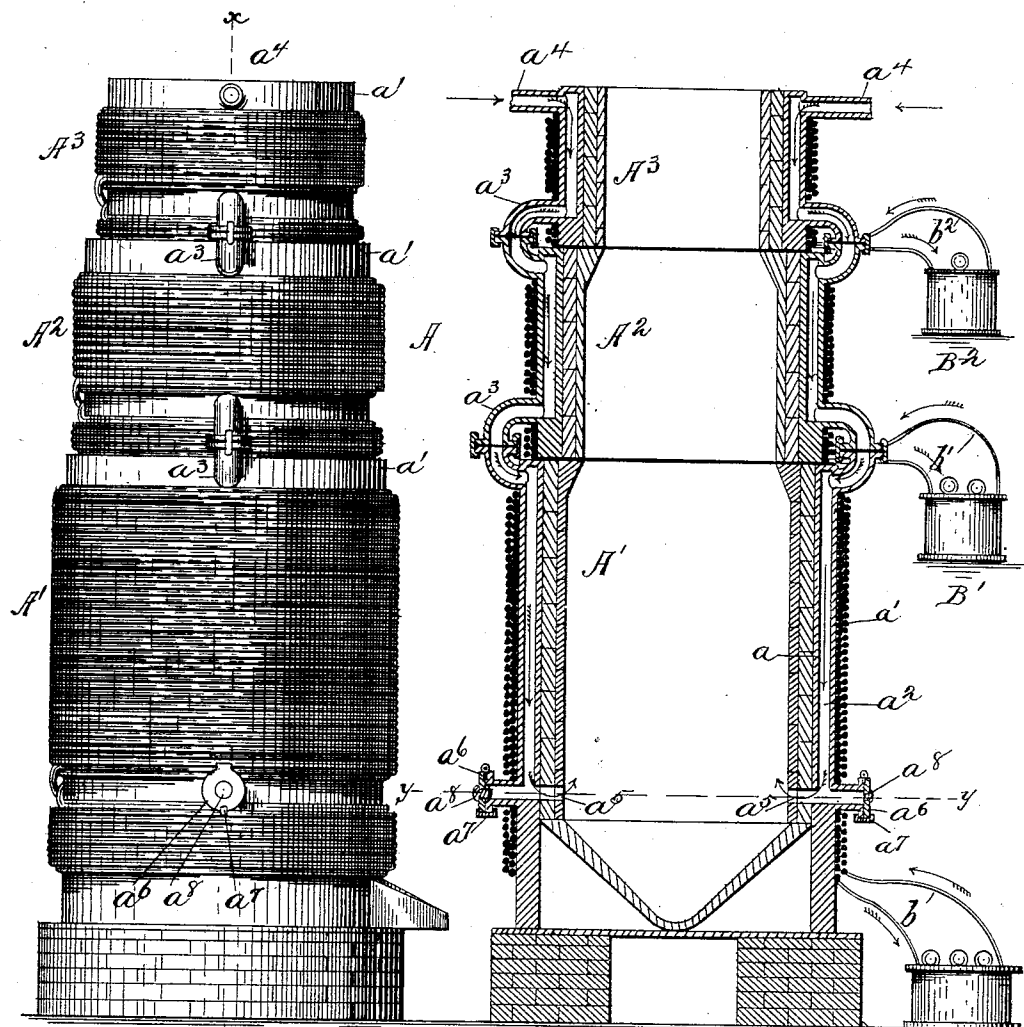
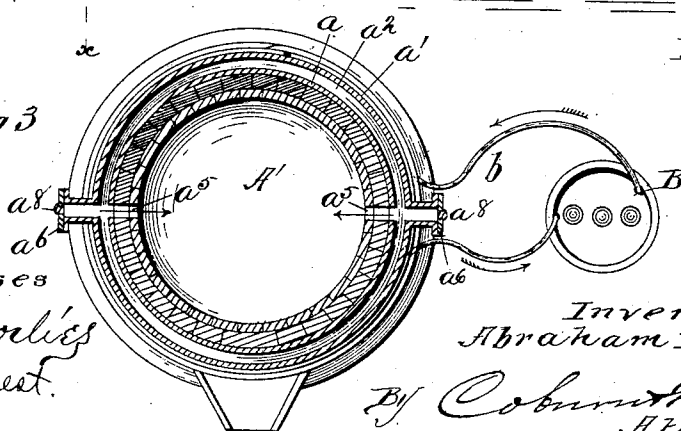


Fig 1

Fig 2

Fig 3



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STACK-FURNACE FOR REDUCING ORES.

SPECIFICATION forming part of Letters Patent No. 390,964, dated October 9, 1888.

Application filed November 6, 1886. Serial No. 218,218. (No model.)

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 a certain new and useful Improvement in Stack-Furnaces for Reducing Ores, which is fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of a furnace embodying my invention; Fig. 2, a vertical sectional view of the same, taken on the line x x of Fig. 1; and Fig. 3, a plan sectional view taken on the line y y of Fig. 2.

Like letters refer to like parts in all the figures of the drawings.

My invention relates to furnaces for reducing ores, metals, &c., and is in the nature of an improvement upon the invention set forth in Letters Patent No. 133,099, granted to me November 19, 1872.

My present invention relates more particularly to certain improvements in the apparatus which I have devised for carrying out the process set forth in said Letters Patent.

I will now proceed to describe a construction in which I have practically embodied my invention in one form, and will then particularly set forth in the claims those features which I deem to be new and desire to protect by Letters Patent.

In the drawings, A represents a smelting-furnace which is surrounded by a jacket of suitable material, preferably iron. The wall of the furnace is shown at a , and the outer shell or jacket at a' , said parts being of such relative size as to leave between them the air-space a^2 . I am aware that, broadly considered, such a structure is not new in smelting-furnaces, and I do not wish to be understood as claiming the same, except as utilized in carrying out my invention in its preferred form. The furnace is formed in the construction illustrated in a plurality of separate sections superposed one upon the other, as shown. In the present instance I have shown three sections, consisting of a lower section, A^1 , a middle section, A^2 , and a top section, A^3 . In case this structure is adopted the air-spaces a^2 of the various sections are independent and closed at top and bottom, being connected by means of pipes a^3 , so that the blast, which en-

ters the air-space a^2 at the top through pipes a^4 , as shown by the arrows in Fig. 2 of the drawings, will pass down through the several air-spaces and their connecting-pipes, and will enter the interior of the furnace through suitable tuyeres or passages, a^5 , suitably located near the bottom of the furnace. The tuyeres a^5 extend outward beyond the sides of the furnace, as shown, and are closed by any suitable means, such, for instance, as hinged doors a^6 , said doors being provided with any suitable locking device, such, for instance, as the clip a^7 , and each having at its center a suitable lens, a^8 , of glass or other material, by means of which the contents of the furnace may be readily inspected when in operation.

When the furnace is constructed in sections in the manner shown in the drawings, there is inserted between the sections a suitable refractory insulating material—such, for instance, as fire-clay or the like—whereby the several sections are each completely insulated and each will form a separate magnet, in the manner hereinafter set forth.

The exterior of the furnace A is surrounded by a coil or series of coils of wire, through which a current or currents of electricity may be passed. The wire employed for this purpose is a copper wire suitably insulated, and the coils are magnetic, being isolated by means of suitable layers of suitable insulating material—such as Manila paper and silicate of soda—arranged between the several layers of each coil and between the inner layer and outer wall. For supplying the electric current to the coils of the various sections, I employ a series of batteries, B B^1 and B^2 , or other equivalent means for generating electricity, equal in number to the number of sections of which the furnace is composed. From one pole of the battery B a wire, b , is led to the lower section, A^1 , of the furnace, and is coiled around the same and returned to the other pole of the battery, thus forming a closed circuit and inclosing within the helix the entire lower section of the furnace, so that the substance contained therein forms a magnetic core when a current of electricity is passed through the coil. In like manner a wire, b' , is led from one pole of the second battery, B^1 , and coiled around the middle section, A^2 , of the furnace, its other end being led back to the battery and connected

to the other pole thereof. A wire, b^2 , is coiled around the top section, A^3 , and connected in like manner to the battery B^2 . It will thus be seen that each section of the furnace is insulated and provided with a separate coil supplied with electricity from a separate battery. The coils may, however, spring from a single battery.

The operation of my improved furnace is in its main features identical with the operation set forth in my Letters Patent hereinbefore referred to, and therefore needs no detailed description here. The operation of the magnetic coils, in conjunction with a double-wall furnace having an air-space inclosed within the coils, is, however, essentially different in some features from that of the single-wall furnace shown and described in my former Letters Patent.

I do not wish to be understood as in any sense claiming, broadly, a double-wall furnace, for I am well aware that this construction of furnaces is old. My invention consists only in the combination of a double-wall furnace with a magnetic coil or coils, and I have found by actual use that very great advantages result from this combination. A double-wall furnace has certain known advantages, and the application of a magnetic coil to a furnace, as stated in my prior patent referred to above, also possesses certain advantages. I have found, however, that the combination of these two improvements in one and the same structure produce results much greater than the same special advantages attributable to each of these old-style furnaces alone. I am able by this combination to readily break down the most refractory ores, even those which have been considered heretofore as practically valueless because it has been impossible to work them. Now, this is due to the fact that I not only obtain the general effect of the magnetic coils set forth in my prior patent and the general effect of double-wall furnaces, which is well known, but I also obtain an additional agent in the effective treatment of the ores in the magnetized air, which is introduced to the furnace, as explained above. In actual use I have found this new furnace producing results greater than were anticipated, and which were somewhat surprising to me.

By constructing the fire-brick wall of the furnace in separate sections and surrounding each section with an outer metallic jacket provided with a separate coil each section becomes a separate magnet having a positive and a negative pole, the opposite poles of the sections being adjacent to each other. It will thus be seen that in charging the furnace the stock or material which forms the charge, as it passes downward toward the bottom of the furnace, will have its polarity repeatedly changed, owing to the fact that the sections are separate magnets. This repeated change in the polarity of the material forming the charge has a most marked effect upon the chemical changes which the charge subse-

quently undergoes, greatly facilitating the production of those results for which the structure is designed. Moreover, independently of any subdivision or magnetization of the jacket or furnace-sections, the use of the series of coils each with a separate battery will increase the efficiency of the furnace in an obvious manner by reason of the magnetic effect upon the stock which forms a magnetic core within the furnace.

Various modifications in the general construction and its details and in the arrangement of the parts may be made without departing from the principle of my invention. For instance, although I have shown one form of double-walled furnace, I do not wish to be understood as limiting myself to that particular form, since it is obvious that any approved form of furnace of that general character may be employed. Moreover, that feature of my invention which relates to the construction of the furnace in insulated sections each surrounded by a separate coil is obviously not limited in its application to double-walled furnaces or to furnaces of any particular construction. It will also be seen that, although I have employed the term "smelting-furnace" to describe the particular form of contrivance for operating upon ores or metals to which I have shown my invention applied, its application is not limited to blast-furnaces, it being equally applicable to various forms of contrivances adapted to this general purpose. I therefore do not wish to be understood as limiting myself strictly to the precise details of construction hereinbefore described, and shown in the drawings.

By means of my invention above described I am enabled to produce a semi-metallic sponge for use as an alloy and purifier of metals—that is, a ferruginous alkalous sponge containing one or more metals belonging to the several isomorphous groups of iron and the alkalis—which sponge may be employed under the ordinary processes of metallurgy—for example, analogously to the use of spiegel.

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

1. A reduction-furnace, in combination with a jacket of suitable material surrounding the same, leaving an air-space between said furnace and jacket, and an electric coil surrounding said jacket, substantially as set forth.

2. A reduction-furnace, in combination with a jacket surrounding the same, leaving an air-space between said furnace and jacket, and a series of separate electric coils surrounding said jacket, substantially as set forth.

3. A reduction-furnace consisting of a series of separate sections, in combination with a jacket surrounding the same, leaving an air-space between said furnace and jacket, and a corresponding series of separate electric coils, one for each section, surrounding said jacket, substantially as set forth.

4. In a reduction-furnace, the combination,

with a series of sections of refractory material,
as fire-brick, having an external metal casing,
of a second shell or jacket surrounding the sec-
tion and forming an air-space through which
5 the blast may pass, air-connections between the
air-spaces of the different sections, blast-inlets
for the top section, tuyeres leading from the
bottom section to the interior of the furnace,
and a series of magnetic coils or helices, each
10 surrounding its corresponding section, sub-
stantially as and for the purposes specified.

5. A reduction-furnace composed of two or

more sections, in combination with a jacket
surrounding the same, leaving an air-space,
said space being subdivided to form an inde- 15
pendent air-space for each section, pipes con-
necting the air-spaces of the adjacent sections,
and electric coils surrounding the jacket op-
posite the respective sections, substantially as
set forth.

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Witnesses:

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