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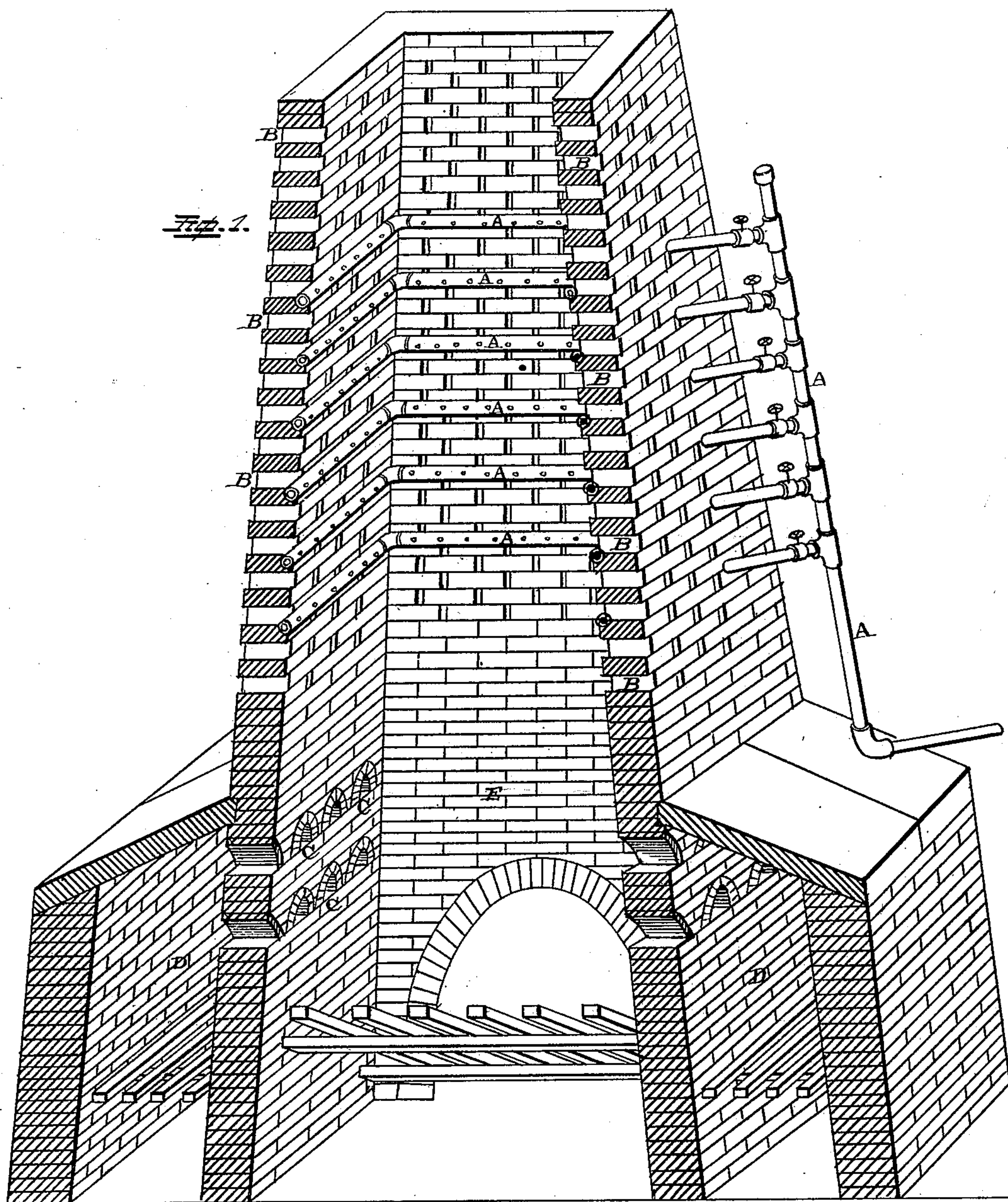
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F. PROTZMAN, C. ADAMS & A. LONGMORE.

CALCINING FURNACE.

No. 256,162.

Patented Apr. 11, 1882.



WITNESSES

H. H. Mortimer  
Wm. H. Kern

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F. A. Lehmann, atty.



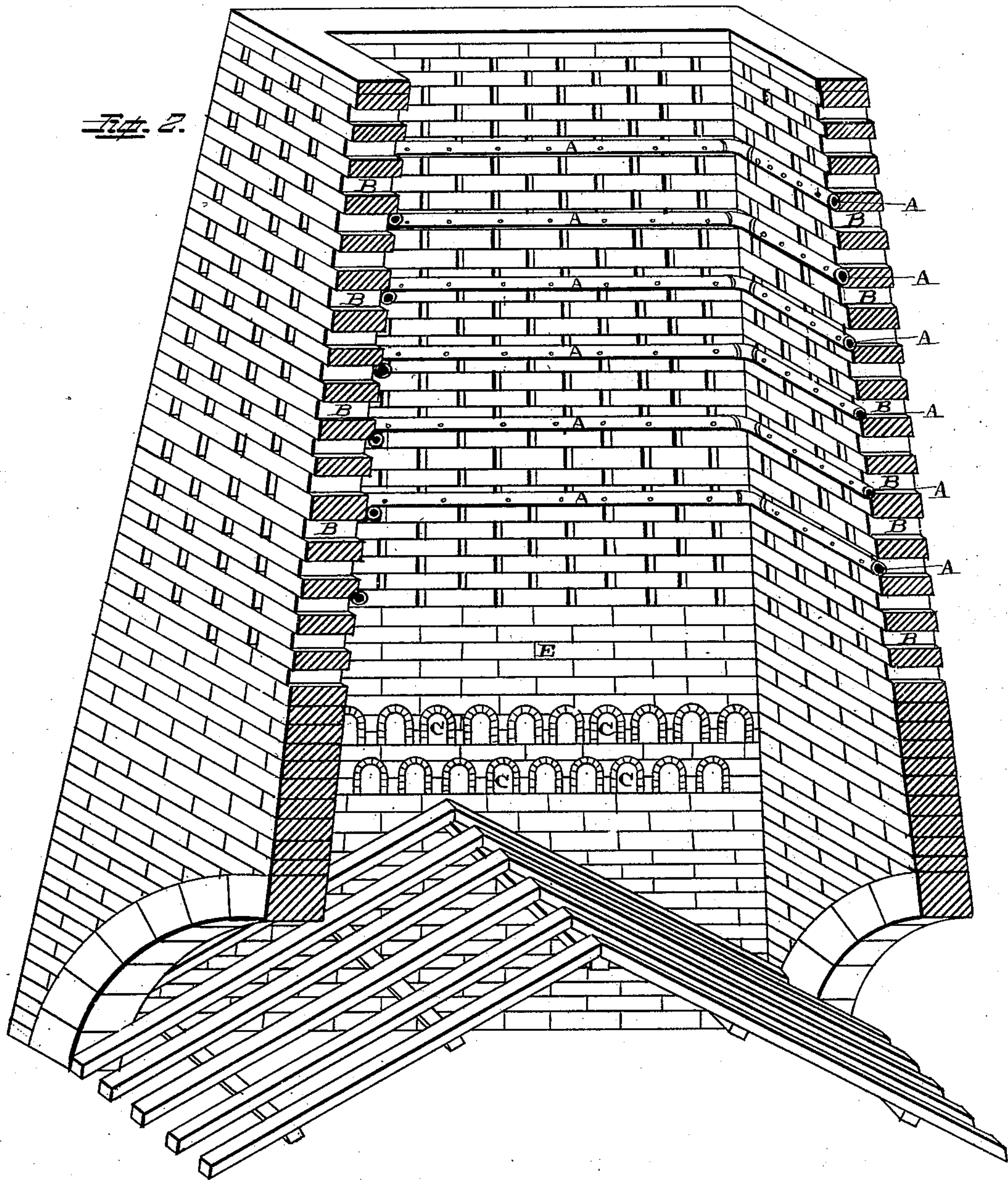
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# UNITED STATES PATENT OFFICE.

FERDINAND PROTZMAN, OF ALLEGHENY, PA., CHARLES ADAMS, OF ST. LOUIS, MO., AND ALFRED LONGMORE, OF ALLEGHENY, PA.

## CALCINING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 256,162, dated April 11, 1882.

Application filed April 23, 1881. (No model.)

*To all whom it may concern:*

Be it known that we, FERDINAND PROTZMAN and ALFRED LONGMORE, residing at Allegheny, in the county of Allegheny, State of Pennsylvania, and CHARLES ADAMS, residing at St. Louis, county of St. Louis, State of Missouri, citizens of the United States of America, have invented certain new and useful Improvements in Calcining-Furnaces; and we do hereby 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Our invention relates to a furnace for dephosphorizing iron ores; and it consists in an arrangement by which hydrogen, set free, being brought in contact with phosphoric acid eliminated by heat from the ore, combines with the phosphorus of the acid, thereby becoming phosphureted, and is then carried off with other gaseous products, leaving the ore free from phosphorus, as will be more fully described hereinafter.

The accompanying drawings represent our invention.

Figure 1 is a vertical end section of the furnace. Fig. 2 is a vertical side section of the same.

E represents the chamber in which the ore is placed; D, chambers for burning the fuel; and C are flues to convey the heat to the ore in E. The outlet-holes B are for the escape of phosphureted hydrogen and other simultaneously-eliminated gases from the ore when brought to the proper temperature.

A are steam-pipes, perforated by small holes at short distances from each other, by which jets of steam or watery vapor are thrown into the furnace.

The inclined gratings or bars shown at the bottom of the ore-chambers E are to allow an

upward passage of air through the column of ore placed thereon.

We prefer the furnaces to be of small dimensions—say four feet across—since by it the discharge of the phosphureted hydrogen is accelerated, which is an essential feature in our process, and the number of open escape-holes should always correspond with the greater or less quantity of steam introduced for a particular kind of ore.

To increase, when necessary, the volume of steam or vapor, we place alternate layers of green wood, previously saturated with water containing chloride of sodium of about 10° Baumé, under and between the ore; but we operate either with or without the chloride, as the case may require.

To successfully operate our furnace we proceed as follows: After filling the furnace with ore placed upon the grating the fire in chambers D is lighted and the temperature raised sufficiently to cause a separation of the phosphorus from the ore, which temperature ought not to exceed 400° Fahrenheit. During this process small jets of steam, so light as to form a watery vapor, are constantly thrown from the steam-pipes into the furnace. The introduction of steam not only prevents the fusion of the metal in the ore, but the hydrogen set free through the decomposition of the vapor by contact with the heated iron ore combines with the eliminated phosphorus of the acid and carries it off through the escape-holes B as phosphureted hydrogen. An equal ratio is to be maintained between the temperature of the ore and the volume of steam introduced, as an increase of temperature without the accompanying moisture would increase the affinity of the phosphorus for iron and prevent a combination with the hydrogen. The phosphorus being removed, the iron attains a higher degree of oxidation.

We are aware that it is old to moisten the fuel with water, and that it is old to inject steam or watery vapor at different elevations in the stack during the calcining operation,

We are also aware that the application of steam, air, or salt is not new for the purpose of desulphurizing ores, and this we also dis-

5 We are also aware that it is not new to pile both the wood and the ore in a furnace for the purpose of calcining the ore, as described.

We claim—

10 The combination of a stack provided with the perforations B in its upper portion with the side furnace or furnaces, D, flues C, and the

perforated pipes A, arranged at different elevations inside of the stack, substantially as shown.

In testimony whereof we affix our signatures 15 in presence of two witnesses.

FERDINAND PROTZMAN.

CHARLES ADAMS.

ALFRED LONGMORE.

Witnesses:

PHILIP BAKER,  
JAMES CULP.