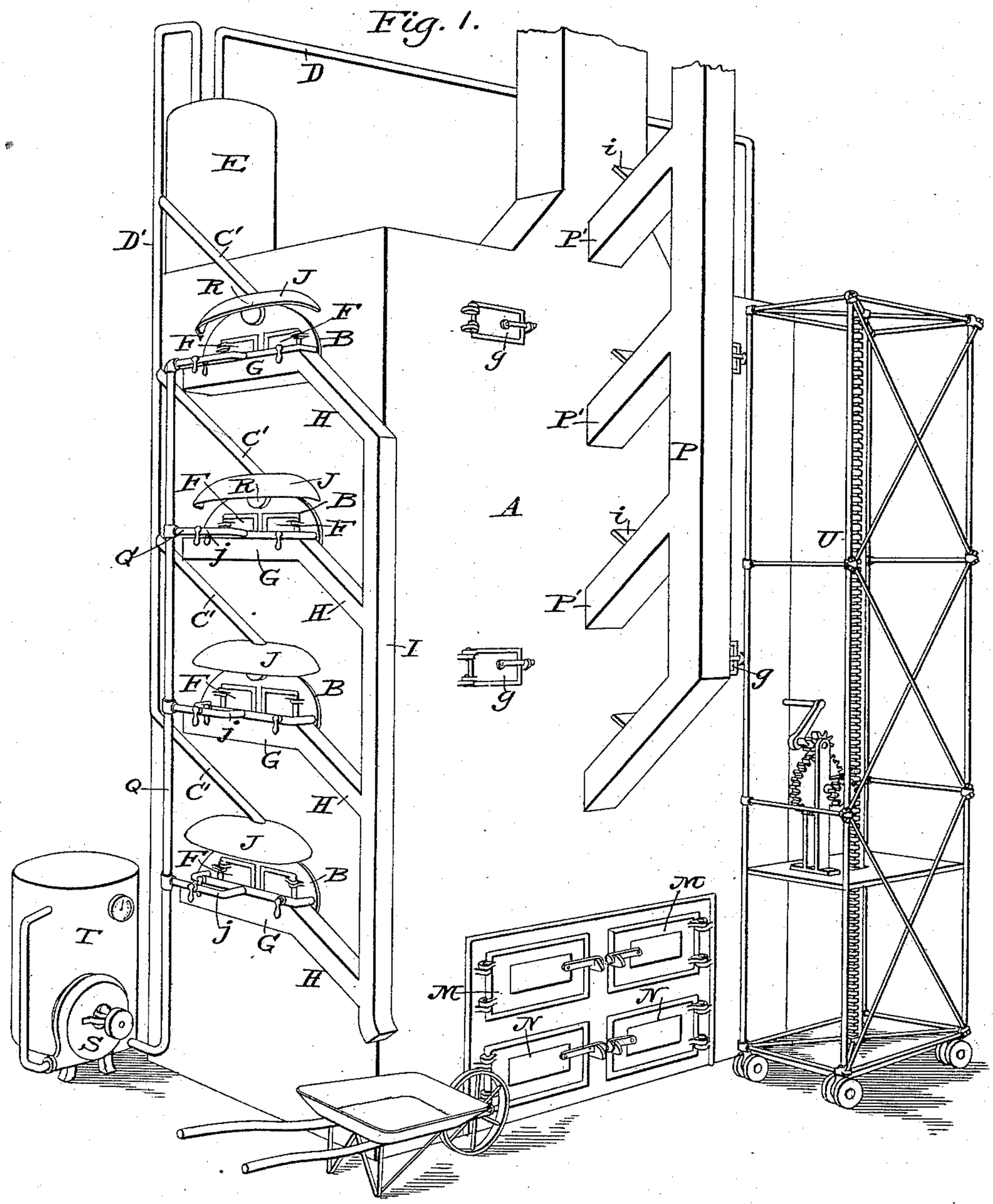
(No Model.) 2 Sheets—Sheet 1.

H. CALHOUN & A. M. BEAM.

CHLORIDIZING MUFFLE FURNACE.

No. 483,532. Patented Oct 4, 1892.

Fig. 1.



Witnesses:
James F. Duhamel.
Horace A. Dodge.

HUGH CALHOUN,
ARON M. BEAM,
Inventors,
by Dodger Sons,
Attys.

(No Model.) 2 Sheets—Sheet 2.

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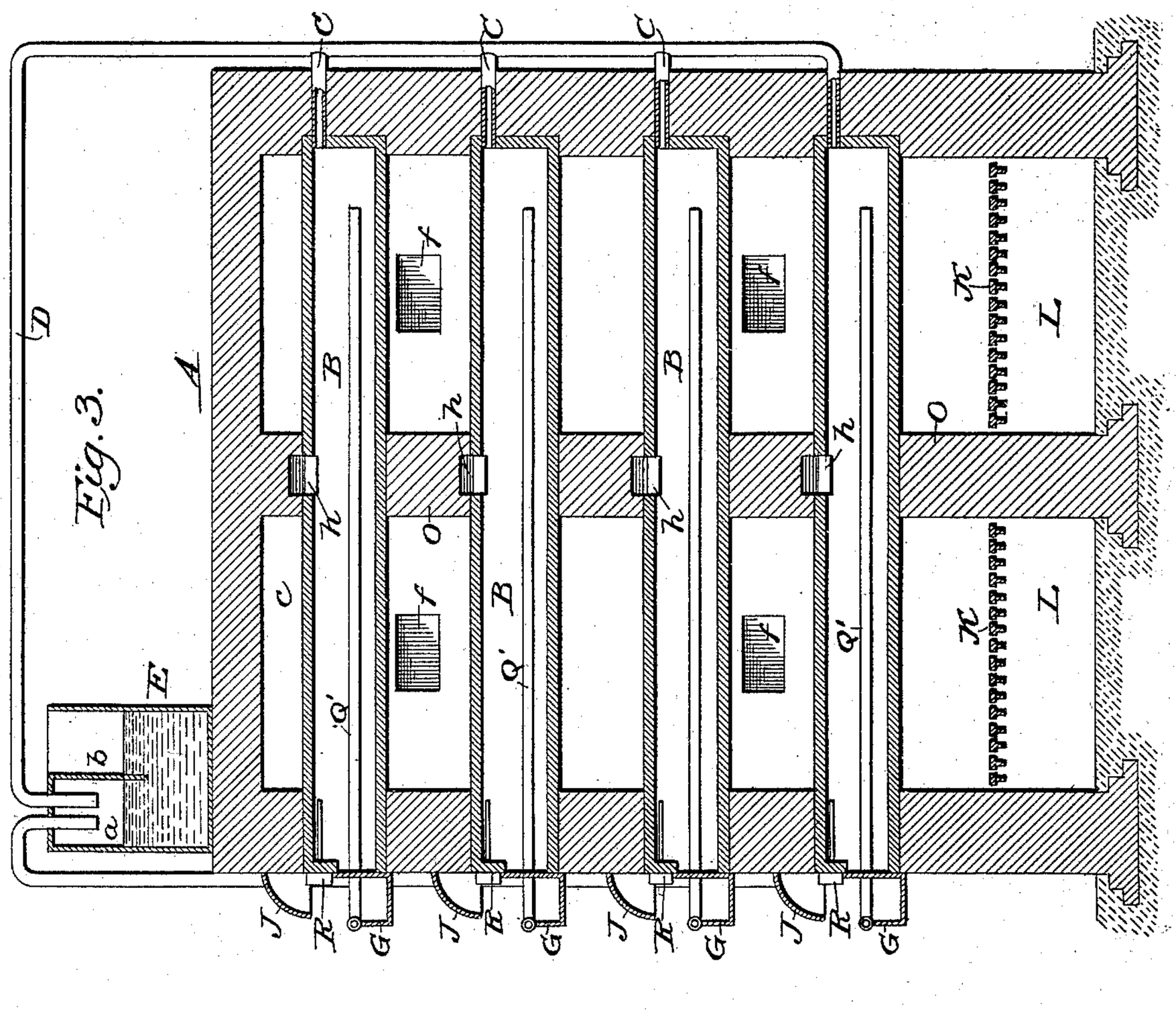

Fig. 3.

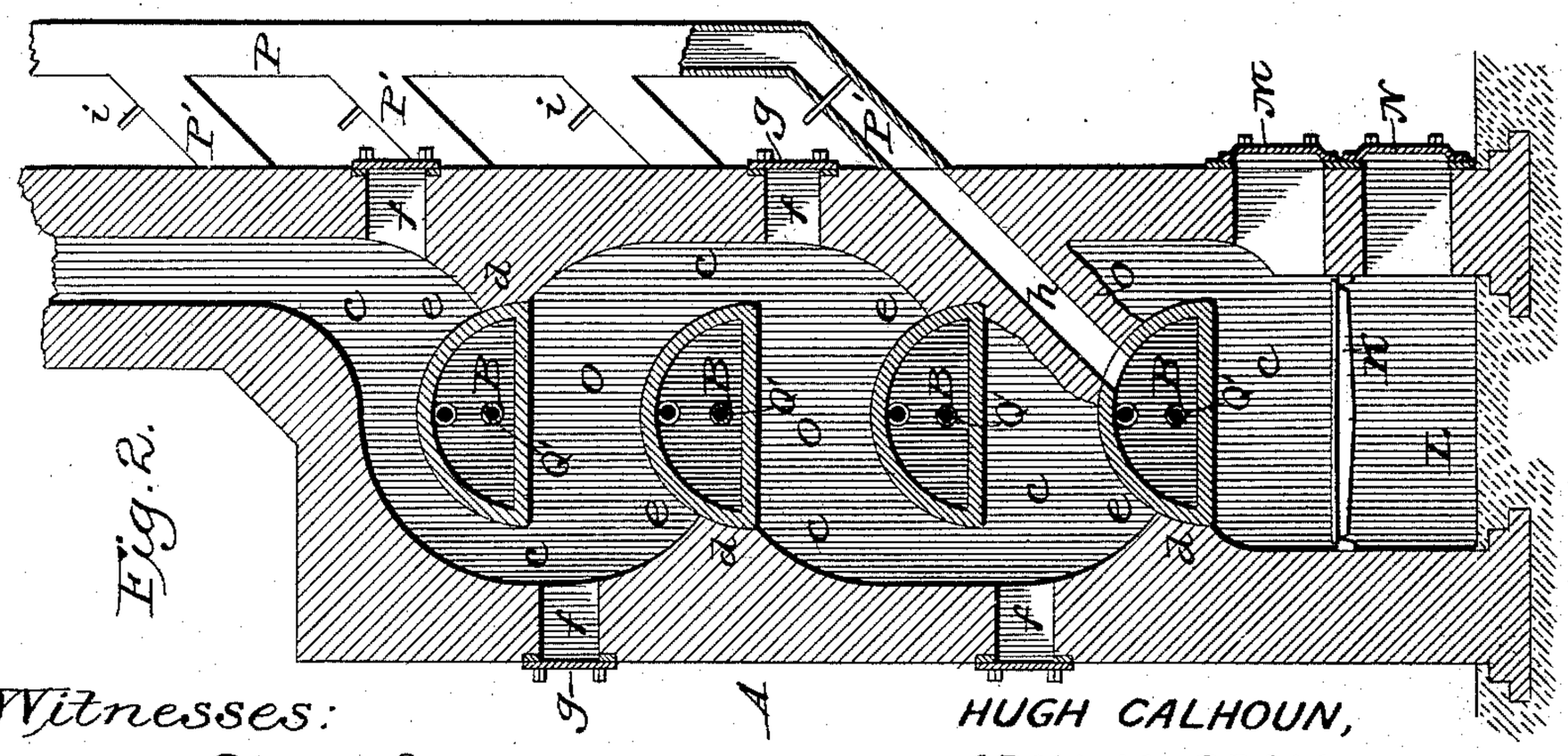

Fig. 2.

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UNITED STATES PATENT OFFICE.

HUGH CALHOUN, OF HOT SPRINGS, AND ARON M. BEAM, OF BEAR, ARKANSAS.

CHLORIDIZING MUFFLE-FURNACE.

SPECIFICATION forming part of Letters Patent No. 483,532, dated October 4, 1892.

Application filed June 30, 1891. Serial No. 397,996. (No model.)

To all whom it may concern:

Be it known that we, HUGH CALHOUN, residing at Hot Springs, in the county of Garland, and ARON M. BEAM, residing at Bear, in the county of Montgomery, State of Arkansas, have invented certain new and useful Improvements in Chloridizing Muffle-Furnaces, of which the following is a specification.

This invention relates to chloridizing muffle-furnaces for roasting ores, and, though adapted for the roasting of ores generally, is more particularly designed for use in carrying out a method or process of treating gold and silver bearing ores set forth in an application filed in the joint names of Hugh Calhoun and Aron M. Beam on the 1st day of April, 1891, designated by Serial No. 387,275.

The special features of the roaster will be explained in connection with the accompanying drawings, in which—

Figure 1 is a perspective view of the oven or roaster complete; Fig. 2, a vertical transverse section through the same; Fig. 3, a vertical longitudinal section.

The objects sought to be attained by this invention are perfect chlorination, the saving of all volatile gold or silver and liberation of those agents which render them volatile, and the avoidance of the loss which now occurs in this class of furnaces by reason of fine particles being carried off by the draft. With these ends in view the roaster is constructed as shown in the drawings, wherein—

A indicates suitable masonry, advisably of fire-brick, of dimensions suitable to contain a series of muffles or retorts B, which latter may be of any convenient or suitable proportions. In practice these muffles may be advantageously made eight feet in length, two feet in width, and sixteen inches in height, semicircular in cross-section, with the flat side at the bottom, as shown in Figs. 1 and 2; but this is wholly a matter of option or judgment. Each muffle is closed at the rear end, with the exception of a vent or escape pipe C near the top, the pipes C of the several muffles communicating with a common uptake-pipe D, the upper end of which bends over and enters the sealed chamber *a* of a tank E. The chamber *a* is formed by covering a suitable portion of tank E—say one-half—and providing the same with a depending apron or plate *b*, which extends downward from the edge of the cover far enough to dip into the water, with which the tank is filled to from half to two-thirds its depth, more or less.

By means of the pipes C and D any volatile matter liberated or driven off by the roasting heat is delivered into the chamber *a*, and having to pass beneath the depending apron *b*, and consequently into and through the water, before escaping to the atmosphere, the gases and volatile matters give up all valuable products carried by them, such products being precipitated in or taken up by the water in the tank, whence they can be removed from time to time. The gold thus carried over is so fine or in such a state that it will mostly be held in suspension in the water; but by filtering the water from time to time over or through charcoal it can be recovered, being taken up and held in the charcoal.

The muffles are each furnished at their front ends with suitable doors F for charging and discharging, if it be desired to charge in this way, though other provision is made for charging, as will presently be explained.

In front of each muffle and on a level with or slightly below the floor of each is a shelf or platform G, from which a chute H extends downward at a convenient inclination to a spout or trunk I, common to all the chutes, and serving to deliver the roasted ores into a barrow or other convenient receptacle.

Projecting forward from the front wall of the masonry structure A are hoods J, one above each muffle, as shown in Figs. 1 and 3. From each hood a pipe C′ extends to and communicates with an uptake D′, the upper end of which opens into the chamber *a* of tank E in the same manner as does the pipe D. The purpose of these hoods and pipes is to collect the gases and volatile matters escaping from the muffles when the doors thereof are opened and to deliver them to the tank E, where the solid particles are precipitated. Beneath the lowermost muffle of the series are arranged suitable grate-bars K, and beneath these again is an ash-pit L, suitable

doors M and N being provided, as usual, for supplying fuel and removing ashes.

The grates may be charged from either or both ends or from the side, as found expedient.

Referring now to Fig. 2 it will be seen that the muffles B are arranged in vertical series and that a flue or passage *c* passes from side to side of chamber A alternately over and under the muffles, so that each is subjected to the heat on nearly its whole surface. The only portion of any muffle not directly subjected to the heat and gases is where the masonry is built against one or the other side to prevent the direct upward passage of the products of combustion, as at *d*, Fig. 2. This drawing in or building of the masonry against the sides of the several muffles serves, also, the further purpose of forming a ledge or bed *e*, upon which and the top of the retort fuel may be placed and burned to increase the heat of any given muffle when necessary. Access is had to these beds or ledges *e* through charging-openings *f*, which are provided with doors *g* or other suitable closures.

For the double purpose of sustaining the retorts and of providing place and protection for charging-chutes, a partition-wall O is built transversely across the chamber A from bottom to top, or from the lowermost muffle upward, as shown in Figs. 2 and 3.

Within the partition-wall O, which is located at or about the mid-length of the muffles, are built chutes *h*, each leading to an opening formed in the top of one or another of the muffles for the introduction of ore, and these several chutes connect with and are supplied by a spout or trunk P, common to all. This spout may extend from an upper floor, an elevated bin or hopper, or other convenient point of supply.

Each branch spout P′, connecting the chute *h* with the trunk P, is furnished with a gate or valve *i*, by which the feed may be regulated or cut off at will.

It is desirable that oxygen be supplied to the muffles during the chlorination of the ore, and for this purpose a supply-pipe Q is provided, branches Q′ being carried therefrom to the several muffles, advisably through the heads or fronts thereof. The branch pipes may extend into the muffles any desired distance and may be perforated to better distribute the air through the batch. Suitable cocks or valves *j* permit the regulation of the air-supply to each muffle.

Pyrometers R indicate the temperature in each muffle and enable the attendant to regulate the firing, as required.

It is obvious that the muffles may be arranged in an inclined series or in zigzag order, though the arrangement shown is preferred.

The necessary supply of air is insured by the use of a fan-blower or like air-forcing device S, and the supply-pipes may be carried within the walls of chamber A before passing to the muffles, if desired, so as to deliver the air in a heated condition. It is desirable to maintain the air at a nearly-uniform pressure, and for this reason an air-receiver T is provided, into which the air is delivered by the blower S and from which it is delivered to the muffles.

The furnace is of considerable height, and it is therefore necessary or at least quite desirable that provision be made for readily reaching each level for charging, stirring, and discharging. This result may be conveniently attained by constructing galleries around the furnace A, or a portable elevator may be provided, as at U.

In the practical application of our invention the procedure necessarily depends in a measure upon and varies with the character of the ore under treatment. Ordinarily it is advisable to maintain the heat at about 600° Fahrenheit until the chlorination is complete, supplying to the charge about one per cent. of oxygen; but after the chlorine gas is entirely eliminated the heat should be raised to from 1,200° to 1,400° Fahrenheit and the supply of oxygen increased to about five per cent.—equivalent to about three and a half ounces pressure, indicated by the gage of tank T. This will eliminate all carbonaceous elements, which will have served previously as a medium or vehicle for taking up and retaining the gold and silver, but which now needs to be burned out to leave the gold and silver free in a substantially-pure state and to some extent aggregated. It is necessary, also, to stir the pulp mass upon the elevation of the temperature to enable the carbon present to come into contact with sufficient oxygen to effect or insure combustion. At this stage of the treatment most ores will stand about three times as much heat without producing cementation that they will at the commencement of the treatment. With lead-bearing ores it would not be advisable to raise the temperature at any time above 600° Fahrenheit; but by the addition of sufficient oxygen—say three to five ounces pressure at the tank, together with longer exposure—the carbon present may all be consumed. Should the heat be carried too high with lead-bearing ores, the lead would take up the gold and silver left behind by the burning out of the carbon where the lead and the gold and silver come into contact. Such a union is not desirable, as it is far more economical to take up the gold and silver by amalgamation with mercury and to concentrate the lead as a by-product. This mode of separating and recovering the lead apart from the gold and silver is believed to be entirely new, and not only simplifies the process of treating such ores, but also greatly enhances their value, making available and valuable many ores that have not been workable at a profit hitherto.

Where the precious metals are combined or are contained in the same or with tellurium, native mercury, lead, zinc, or other volatile

or volatilizable elements, the apparatus above set forth is admirably adapted to perform the work of desulphurization without loss of the precious metals. The air-supply, being under perfect control, can be so regulated as to cause the consumption of the sulphur and other combustible elements and enable their heat to be utilized and the heat to be kept at the precise degree required. In this way cementation is avoided. When working lead-bearing ores in the manner indicated, if the ore be fine the lead will be found in the form of a black powder or black granules after the sulphur is eliminated. It is advisable that the ore be reduced to the size of grains of corn or of wheat, approximately, preparatory to desulphurization; but for chlorination the preliminary reduction should be of a size to pass through a screen of from sixty to eighty meshes to an inch.

Having thus described the invention, what is claimed as new is—

1. In a muffle-furnace, the combination of a containing-chamber and a series of muffles arranged one above another within said chamber and alternately placed in contact with opposite sides thereof, whereby a circuitous flue is formed about the muffles and a ledge is provided above each muffle upon which to burn fuel when required, and charge-openings through which to introduce fuel to said ledges.

2. In combination with chamber A, provided with zigzag flue *c*, muffles located one above another in said flue, ledges *e* at one side of each muffle, feed-openings *f* above the ledges *e*, and doors or closures for said openings.

3. In combination with chamber A and muffles B, provided with inlet or charge openings, partition-wall O, provided with chutes *h*, registering with the charge-openings of the muffles.

4. In combination with a furnace-chamber and with a muffle located therein and provided with doors, a hood located above the doors, a tank, and a pipe connecting the hood and the tank and serving to convey matters collected by the hood to the tank.

5. In combination with furnace-chamber A and muffles B, located in said chamber one above another, pipes Q Q′, extending into the muffles, blower S, communicating with pipe Q, and receiver T, interposed between the blower and the pipe Q and serving to equalize the air-pressure.

6. The method of extracting lead from gold or silver bearing ores, which consists in first reducing the ore to granular form, heating said ore in a closed receptacle in the presence of sufficient oxygen to insure the combustion of the carbonaceous matter present, the temperature being maintained at or slightly below 600° Fahrenheit, and finally removing the lead from the mass in the form of black particles, which it assumes under the treatment stated.

In witness whereof we hereunto set our hands in the presence of two witnesses.

HUGH CALHOUN.
ARON M. BEAM.

Witnesses:
E. C. BEAM,
J. A. BENNETT.