(No Model.) 2 Sheets—Sheet 1.

V. COLLIAU.

FURNACE FOR REDUCING ORES.

No. 284,384. Patented Sept. 4, 1883.

Fig. 2.

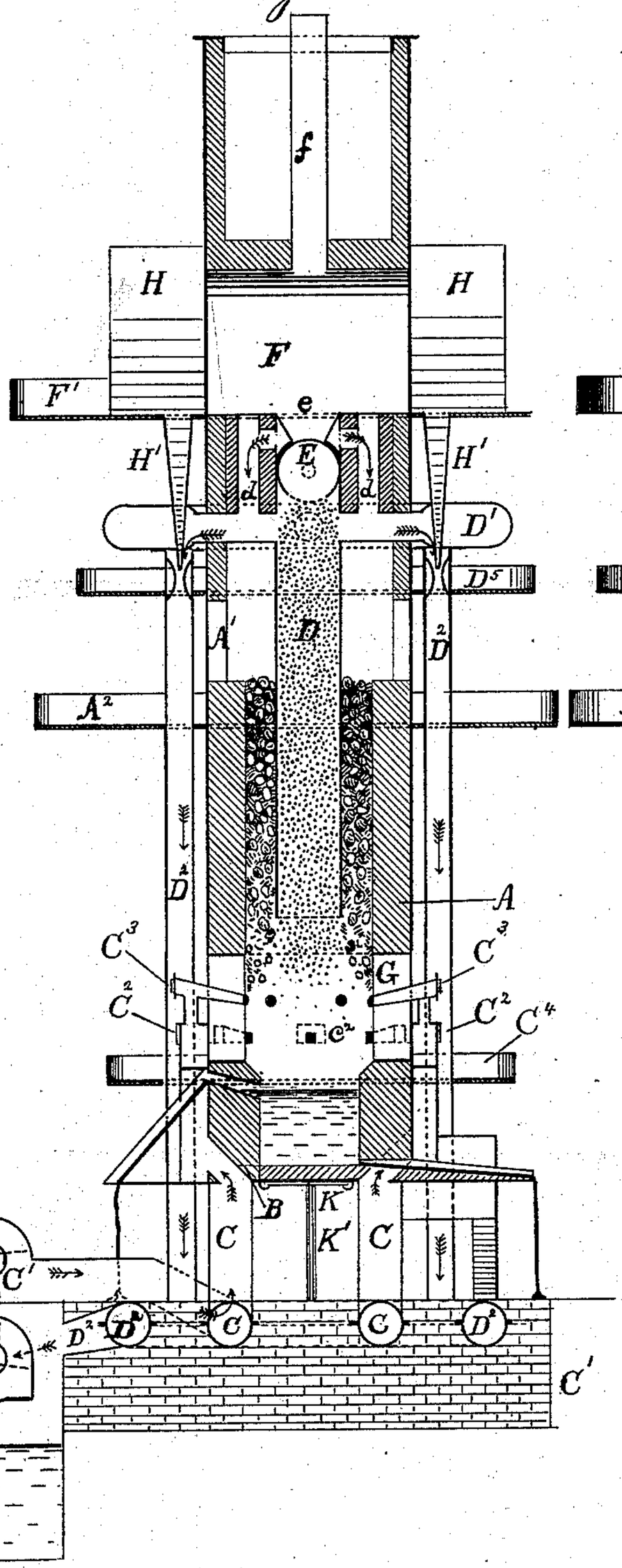
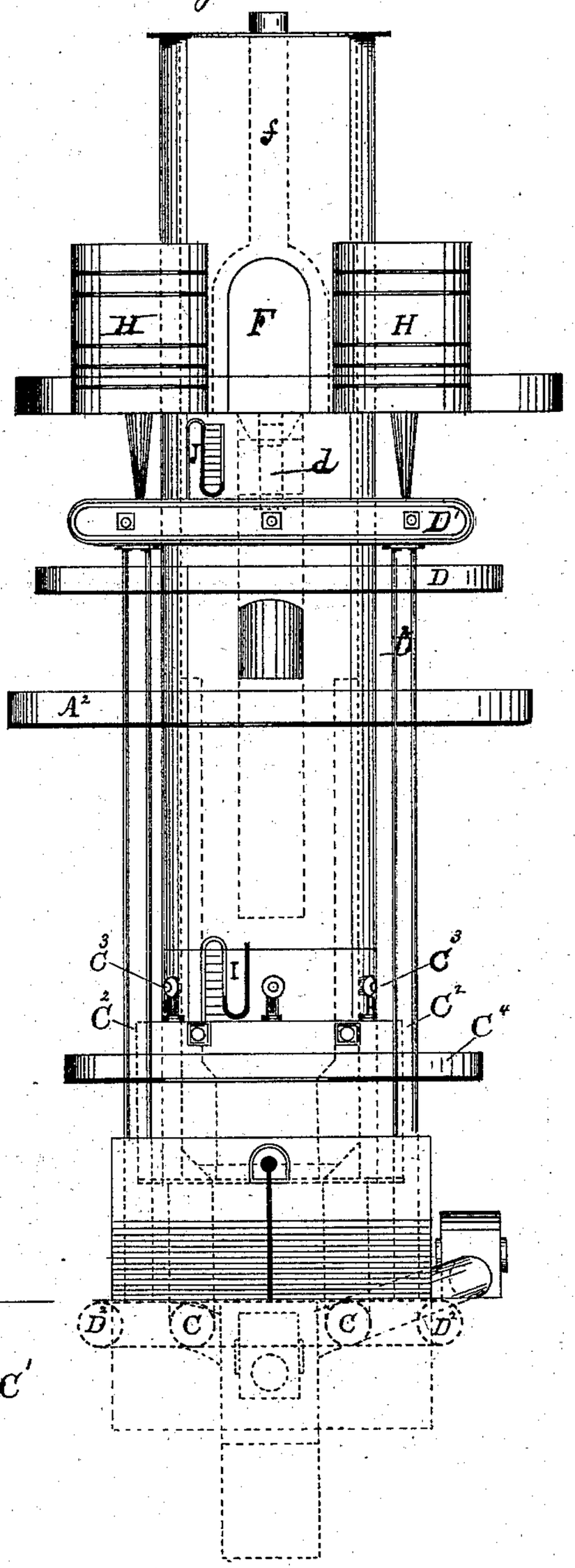


Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

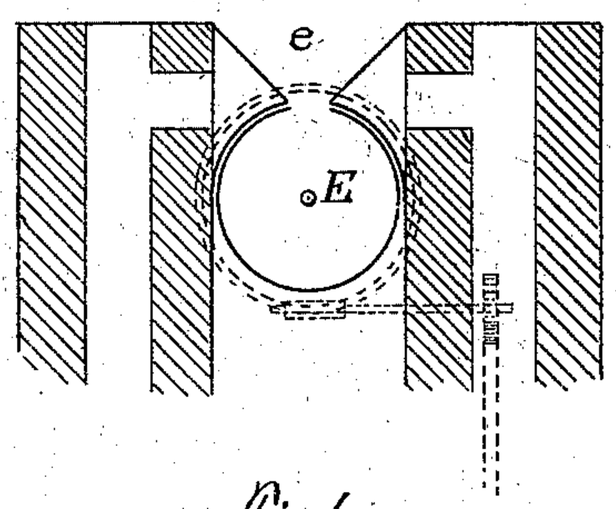


Fig. 4

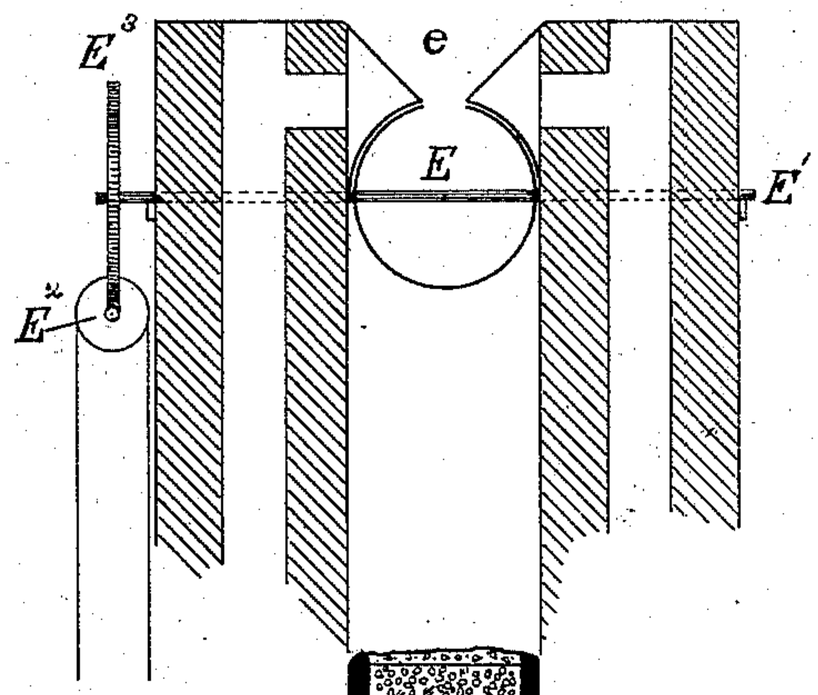


Fig. 6.

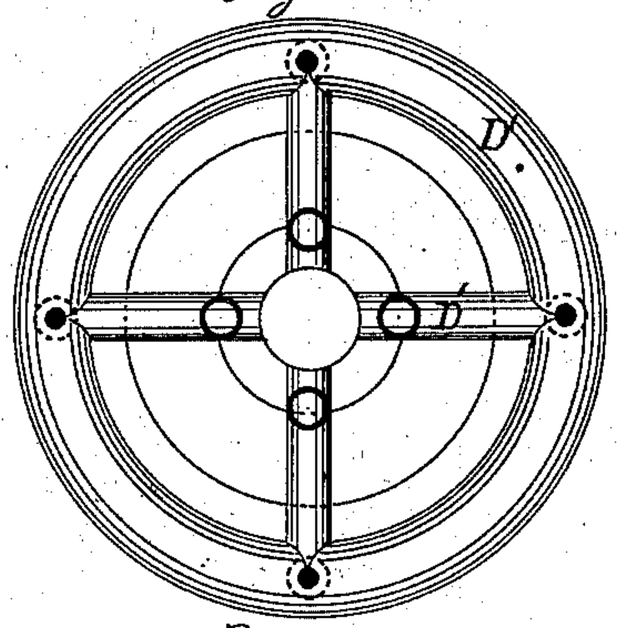


Fig. 8.

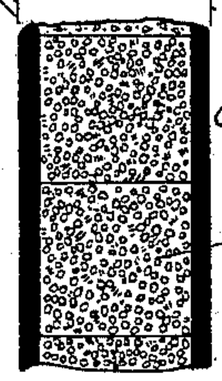


Fig. 7.

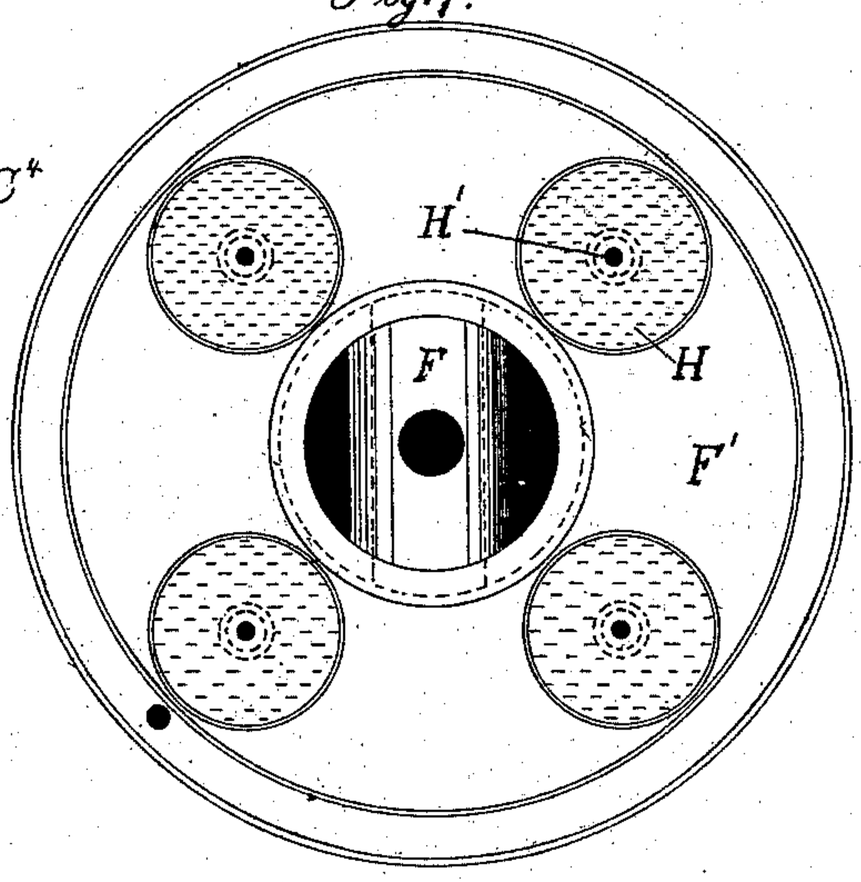
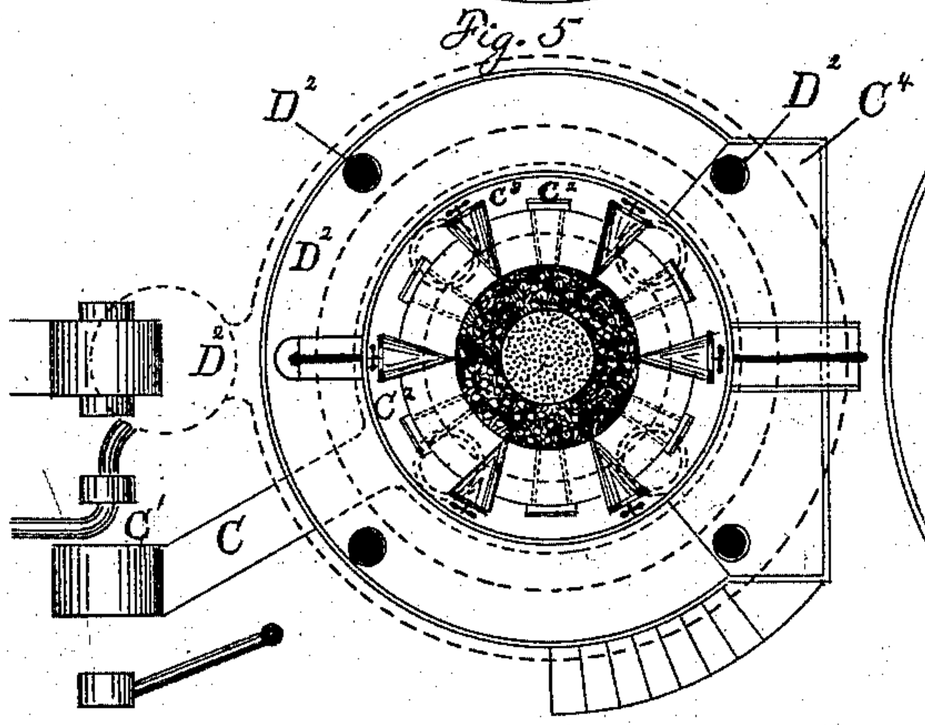


Fig. 5



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UNITED STATES PATENT OFFICE.

VICTOR COLLIAU, OF DETROIT, MICHIGAN, ASSIGNOR TO THE COLLIAU FURNACE COMPANY, OF SAME PLACE.

FURNACE FOR REDUCING ORES.

SPECIFICATION forming part of Letters Patent No. 284,384, dated September 4, 1883.

Application filed October 27, 1881. (No model.)

To all whom it may concern:

Be it known that I, VICTOR COLLIAU, of Detroit, county of Wayne, State of Michigan, have invented a new and useful Improvement in Furnaces for Reducing Ores and Metals; and I declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to that class of reducing-furnaces in which the ore or metal and the fuel are kept separately, except at the point of fusion of the metal, its main object being to facilitate the purification of the metal by preventing the gases generated from the same, or from ores and fuel, from remaining in contact with the metal or with highly-heated ores.

The invention consists in certain novel improvements, which will be hereinafter fully described, and pointed out in the claims.

Figure 1 is a front elevation of a smelting-furnace embodying the features of my invention. Fig. 2 is a vertical central section. Fig. 3 is a longitudinal and Fig. 4 a cross-sectional view of the feeding mechanism for feeding the central cylinder. Fig. 5 is a horizontal section through the water-bosh, a little above the upper tuyeres. Fig. 6 is a plan view of the flues at the top of the inner cylinder. Fig. 7 is a plan view, looking from the top down upon the floor, from which the inner cylinder is charged. Fig. 8 represents a variation in the construction of the inner chamber.

In carrying out my invention, A represents an outer cylinder or shell, made of boiler-iron, cast-iron plates, or other suitable material, lined with fire-clay, brick, or other refractory material throughout. It rests upon a bottom plate, B, which latter is elevated on hollow columns C, which rise from a foundation, C'.

D is an inner chamber made of refractory material. It depends down into the outer cylinder, A, to a point slightly above the zone of fusion. It is provided at its top with flues D', which communicate with diving-flues D'', and the latter terminating at the bottom in a common conduit leading to a discharge-opening, D'''.

A' is a fuel-feeding door, from which the furnace is charged with fuel from a platform, A''. The space between the inner and outer cylinders is the fuel-space, into which the fuel descends in a column unmixed with ore, metal, or flux. The inner chamber, D, is designed for the ore or metal deoxidizing carbon and the necessary fluxes, in which they descend in a column unmixed with the reducing-fuel.

F is a passage through which ore, &c., from the platform F' is charged into the inner cylinder, D. Any suitable feeding device may be employed at this point. The one shown consists of the hollow sphere E, suspended so as to revolve upon a shaft, E', through the medium of a worm-gear, E'', and pinion E'''. A chute is superimposed above the hollow sphere E to direct the charge into the latter. The hollow sphere is then revolved and the contents emptied into the ore-chamber D, beneath the feeding-sphere E, fills the passage above the ore-chamber, and prevents the escape of vapors through this channel. It also facilitates the formation of the partial vacuum in the chamber D, as will be hereinafter explained.

D'''' represents a fan, and *c'* another fan.

c'' is a lower series, and *c'''* an upper series, of tuyeres.

G is a water-bosh surrounding the zone of fusion, and through which the tuyeres pass.

The operation of the device in outline will now be understood. The furnace having been charged with fuel in the outer and with ore, flux, &c., in the inner chambers, the blast of air from the fan *c'* through the tuyeres *c''* and *c''* produces a reducing heat beneath the discharge end of the inner chamber. Here, for the first time, the fuel and the ore have been brought into contact. The fuel affords sufficient escape through it for the gas to be set free therein, without permitting the gas to come into contact with the higher-heated ore or metal in the inner chamber. At the same time, by any suitable means—as, for instance, by the fan D''''—a suction is maintained upward through the chamber D, flues D' and D'', and out through the passage D'''. This suction or partial vacuum draws away at once sulphurous, phosphoric, and carbonic acids, carbonic oxides, &c., as soon as they are set free from the inner chamber by the increasing temperature. The deleterious gases are not permitted to come in contact with the

metal or ore after the latter have become heated sufficiently to give them off, and the result is that the ore and metal is highly purified, and heat from the burning fuel is utilized to the best advantage and without the usual waste of fuel and metal which takes place when the mass of fuel and ore or metal and its fluxes are charged in alternate layers and caused to descend through the same column.

I would have it understood that I do not confine myself to a structure in which the ore or metal chamber D is concentric with the exterior fuel-chamber, A, though I prefer this construction. The fuel-chamber, however, and that designed for the ore or metal may, if desired, be side by side, and not one within the other; or any other suitable arrangement may be employed—as, for instance, the inner chamber may be employed for fuel and the exterior chamber for the ore.

In order that the gaseous products arising from the ore-chamber D may be utilized as fuel in other parts of the establishment, I provide tanks H, with discharge-spouts H′, which project, like an injector-nozzle, into the contracted upper ends of the diving-flues D″. From these spouts a spray or volume of water is discharged and serves to wash out the gaseous products of sulphuric, phosphoric, and carbonic acids, and the like from the inflammable ingredients, and it permits inflammable ingredients—such as carbonic oxide—to pass onward to the location where it is utilized as fuel, and this feature of producing a suction for the inner chamber and washing out the non-inflammable ingredients with water and using the inflammable ingredients for fuel is another particular feature of my invention. I propose, also, generally to employ the water from the tanks H for the purpose of maintaining and producing a partial vacuum within the inner chamber, D, instead of (or, if desired, in addition to) employing a fan, D‴″, for that purpose, to draw the water from the discharging-spouts H′. Another feature is the contracted upper ends of the diving-flues D″. This water, by reason of its own weight, in descending, serves to create a partial vacuum behind it, and by continuously discharging in this way the water creates and maintains this partial vacuum. The fan D‴″ at the bottom may simply serve to drive the gaseous products forward to a point where they are desired for fuel, but also, if desired, to increase the suction.

f represents a flue leading out from the crown of the arch-passage F, and the main flue above the fuel passes upward upon both sides of the said arch.

d represents flues leading from the sides adjacent to the charging device, so that gases finding their way to this point are drawn off by the suction below.

I have represented upon the drawings a platform, C‴″, for obtaining access to the tuyeres, another, D⁗″, adjacent to the flues D′, also an air-gage for the blast at I, and a vacuum-gage for the inner chamber, D, at J. These, however, do not require special description, as they are of ordinary construction.

The inner chamber, D, may be made of metal or of any other suitable material, and the distance to which it may descend will be dependent upon the point at which it can withstand the heat adjacent to the zone of fusion.

I have represented in Fig. 8 the inner chamber lined with sections of carbon, metal, or other suitable material, the design being that they shall descend with the contents of the cylinder and be consumed or melted at the zone of fusion as they protrude into it. This structure would insure that the fuel and the contents of the inner chamber should not come together until they were well within the zone of fusion. These slide-sections may be unbroken cylinders, or in the nature of stoves, each of which constitutes a segment of the cylinder, and may be made of suitable lengths.

The superincumbent column within the furnace rests upon a hinged bottom plate, K, which may be supported by a suitable prop or other support, K′. When it is desired to discharge the furnace, the prop is released, the door drops, the contents fall out, and cool air rushes in and quickly cools it off.

I am aware that a reducing-furnace provided with a vertical central ore-chamber and a surrounding fuel-chamber is not new with me, and I do not claim such a furnace, broadly.

What I claim is—

1. In a furnace for reducing ores and metals, the combination of chamber D, exterior chamber, A, a common combustion-chamber below the two chambers, the flues D″, communicating with said chambers, a fan for creating a draft down the flues D″, and the tank H, having spouts H′, opening into flues D″, substantially as described.

2. In a furnace for reducing ores and metals, the combination of chamber D, chamber A, a common combustion-chamber below said chambers, a revolving hopper, E, for feeding ore to chamber D, flues D″, communicating with chambers A and D, and a device for creating a downward draft through said flues, substantially as described.

3. In a furnace for reducing ores and metals, the combination of chambers A and D, a common combustion-chamber below said chambers, and a sliding lining to the chamber D, substantially as described.

4. In a furnace for reducing ores and metals, the combination of chambers A and D, the flues D″, contracted at their upper ends, and the tanks H, having spouts H′, communicating with flues D″, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

VICTOR COLLIAU.

Witnesses:
V. K. MOORE,
B. G. CHAPPEE.