No. 829,574. PATENTED AUG. 28, 1906.

O. B. DAWSON.

FURNACE FOR THE IMMEDIATE PRODUCTION OF METAL FROM ORES.

APPLICATION FILED OCT. 25, 1905.

2 SHEETS—SHEET 1.

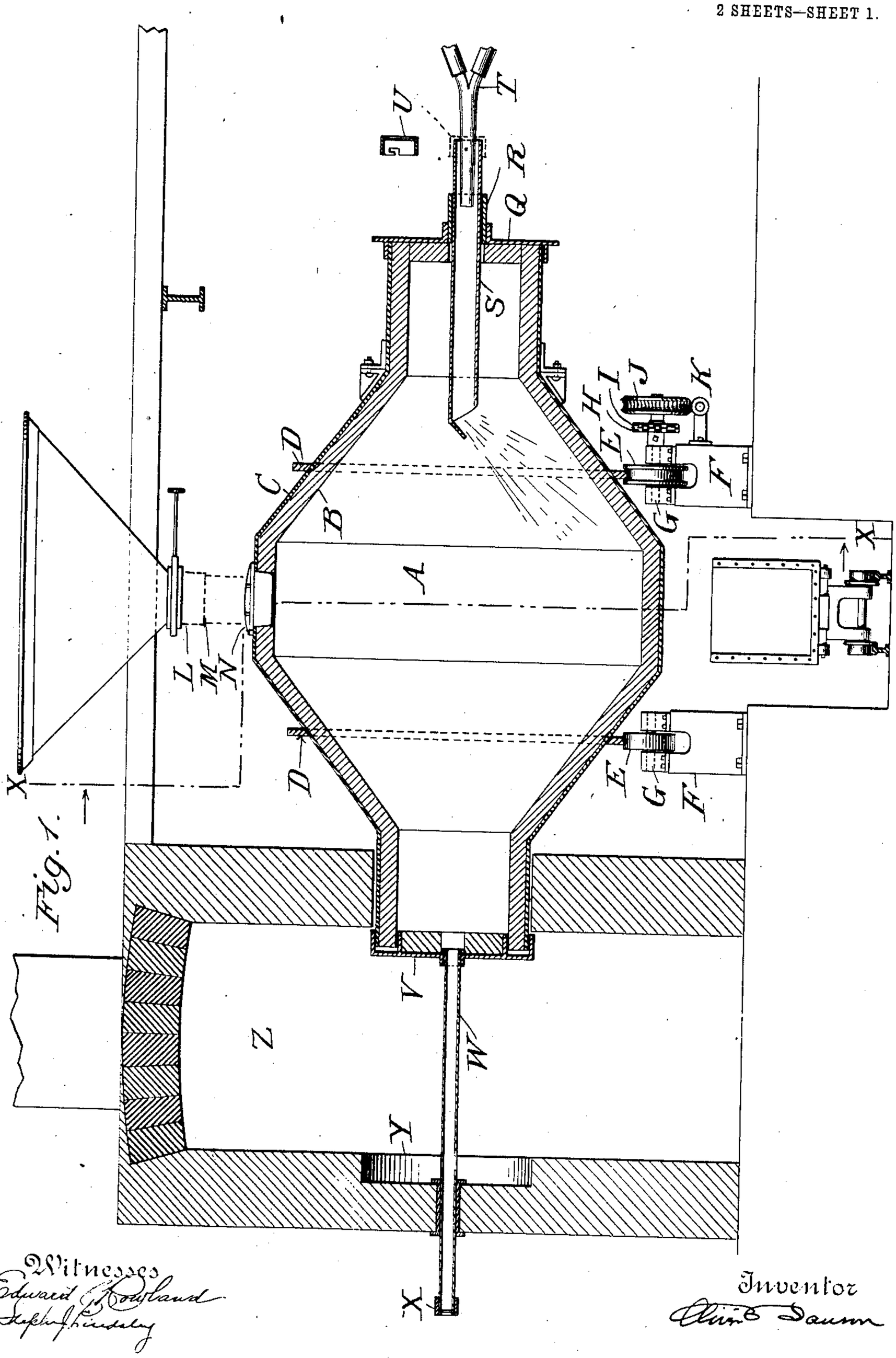

Fig. 1.

Witnesses
Edward Copeland
Stephen Lindsley

Inventor
Oliver B. Dawson

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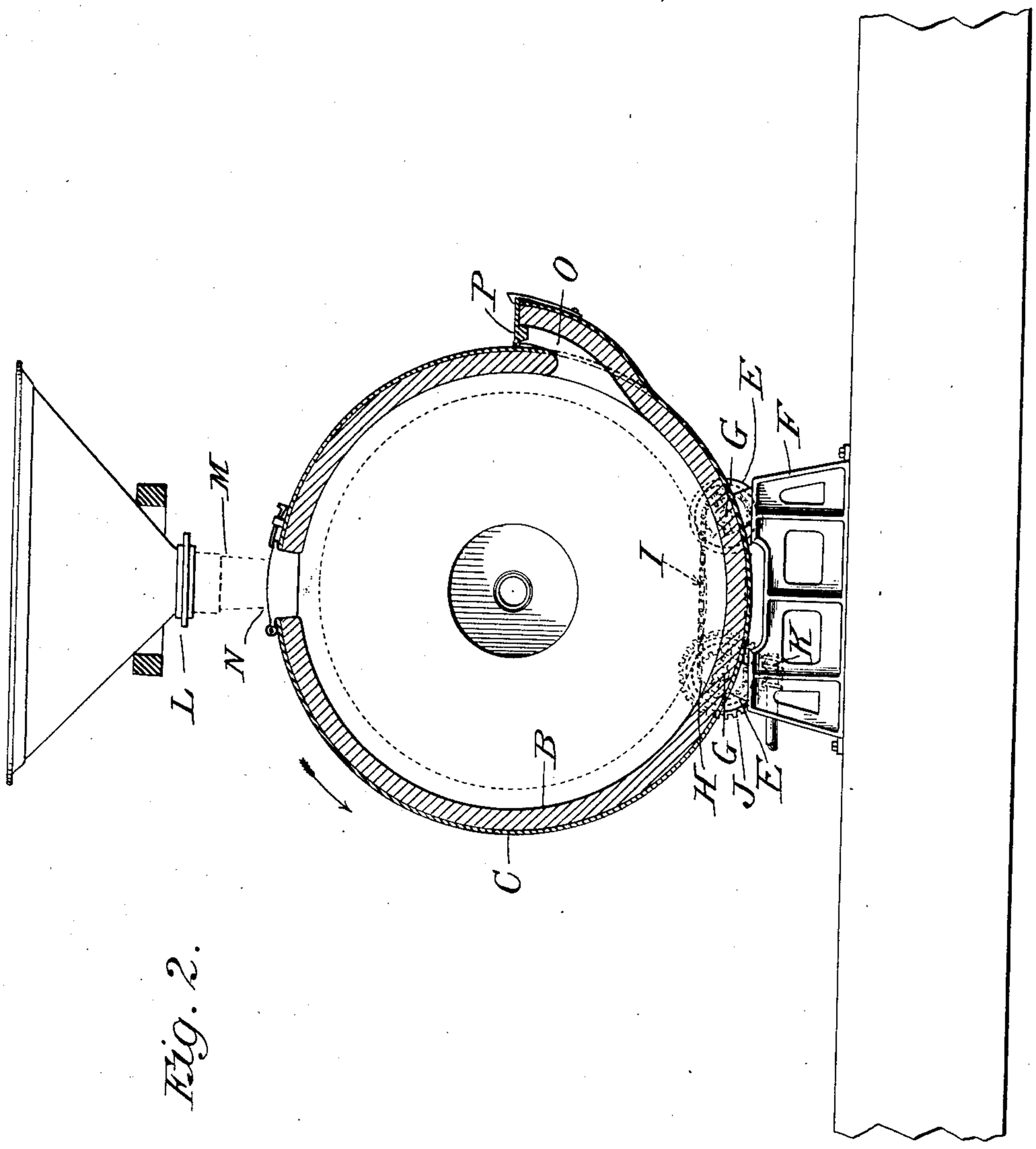

Fig. 2.

Witnesses:
Edward C. Bowland
Stephen Bindley

Inventor:
Oliver B. Dawson

UNITED STATES PATENT OFFICE.

OLIVER B. DAWSON, OF CALDWELL, NEW JERSEY.

FURNACE FOR THE IMMEDIATE PRODUCTION OF METAL FROM ORES.

No. 829,574. Specification of Letters Patent. Patented Aug. 28, 1906.

Application filed October 25, 1905. Serial No. 284,382.

To all whom it may concern:

Be it known that I, OLIVER B. DAWSON, a citizen of the United States, residing at Caldwell, in the county of Essex, State of New Jersey, have invented a new and useful Machine or Furnace for the Immediate Production of Metal from Mineral-Bearing Ore; and I do hereby declare the following to be a full, clear, and exact description of the invention.

The object of this invention is to provide a practical instrument to carry out the theory immediate reduction—that is, the production of metal from mineral in ore without either previous or subsequential treatment.

Modern smelter practice is first (oxidize or chloridize) roast the ore, then to smelt with flux to a concentrated product called "mat," (metal bearing but not metallic,) then to blow in the bessemerizer to an impure metal for casting into anodes for electrolysis, four distinct and separate processes or acts previous to melting for bar and sheet mill.

By the use of my invention metal is produced from the ore by one operation, best described as the art of immediate reduction.

The object of this invention is to provide a furnace which will lower the cost of the commercial production of metal from ore.

A further object is to provide a furnace in which every change in the thermo-chemistry of reduction can take place without changing the charge from one chamber to another.

A further object is to provide a furnace in which copper and silver, gold and iron mineral bearing ores can be converted into metal by immediate reduction at a temperature below the temperature of fusion, and the metallic particles recovered by the usual process of panning or concentration.

I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of the entire machine and lower part of stack. Fig. 2 is a cross-section of Fig. 1, taken on the line of X X looking in the direction of the arrows.

Similar letters refer to similar parts in the two views.

A shows in section the cavity or chamber of the fire-brick-lined steel shell C.

B shows refractory fire-brick lining.

C shows the steel shell; D, the circular track; E E, the wheels on which the circular track revolves; F F, bearing-blocks; G G, shafts on which bearing-wheels revolve; H, sprocket; I, sprocket-chair. J shows worm gear-wheel; K, worm-shaft.

L shows telescopic tube of hopper; M, lower end of same.

N shows charging-door of furnace.

O shows slag-spout; P, tight trap of spout; Q, tight cap of combustion end of furnace; R, movable sleeve for gas-mixing chamber; S, adjustable fuel-gas-mixing chamber; T, conical blowpipe for fuel-gas and air under pressure; U, tight asbestos-lined cap for excluding oxygen; V, tight removable cap on flue-gas chamber end to permit the escape of flue-gases and to prevent the ingress of air or oxygen; W, hollow steel observation-tube; X, mica-covered cap.

Y shows recess for cap V; Z, dust-chamber in lower end of stack.

Finely-broken ore in the case of oxids, carbonates, and lump-roasted sulfids are charged into the furnace through the hopper without flux or fuel, the charging-door is closed and latched, the furnace is now slowly rotated, (about one revolution in five minutes,) the blow-pipe is withdrawn, and the air and gas or oil turned on and ignited. The blowpipe is now thrust into the gas-mixing chamber and perfect or imperfect combustion obtained, according as you thrust in or withdraw the blast-blowpipe, since the air for combustion will be sucked in between the blowpipe and the walls of the gas-mixing chamber. In this manner you may obtain an oxidizing, a neutral, or a reduction flame, and by pushing in or withdrawing the gas-mixing chamber you may deliver this character of flame to any part of the furnace, and so produce a hot hearth.

The furnace having been charged and the charge heated to bright incandescence by the direct application of the proper flame from the end of the gas-mixing chamber, the occluded gases and moisture will now have been driven off. The rotation should cease with the charging-door uppermost, the gas and air should be turned off, the blow-pipe withdrawn, and the outer end of gas-mixing chamber closed with cap U, and through the hopper a charge of some agent capable of reducing metallic oxids (preferably granular carbon or hydrocarbon compounds) should be introduced. The furnace is again

closed and rotated and an intimate mechanical mixture of the finely-broken ore and granular carbon is produced. The incandescent carbon will immediately attack the mineral, reducing it to metal and carbon-dioxid gas, and the carbon-dioxid gas in the presence of the incandescent carbon will be instantly split up into nascent carbon monoxid, a powerful and searching reduction agent. During all this time oxygen has been excluded, because of the closure of the apertures and the internal pressure of the generated gases. In actual practice I have found twenty minutes sufficient time for the action of the incandescent reduction agent. I am inclined to believe that the extreme chemical activity is exhibited at about 1,400° Fahrenheit, the melting temperature of silver, copper, and iron being all much higher than this.

I have in actual practice found incandescent carbon to be the most active of reduction agents. It instantly reduces hydrogen oxid (H_2O) when as hydrogen absolutely refuses to reduce carbonic oxid (CO) at any attainable temperature, clearly showing the relative affinity for combined oxygen.

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

1. The combination with a rotatable internally-heated reduction-furnace, means adapted to deliver the heating-flame to any part of the charge or hearth, a gas-mixing chamber and means for regulating the character of the flame.

2. The combination with a rotatable reduction-furnace having a firing means at one end and flue connections at the other, caps with fireproof lining for covering the firing and the flue ends respectively.

3. The combination with a rotatable reduction-furnace having a firing means at one end and flue connections at the other, caps with fireproof lining for covering the firing and the flue ends, and an inspection-tube leading through the stack and the cap for the flue end of the furnace.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

OLIVER B. DAWSON.

Witnesses:
STEPHEN J. LINDSLEY,
WILLARD O. DAWSON.