

(No Model.)

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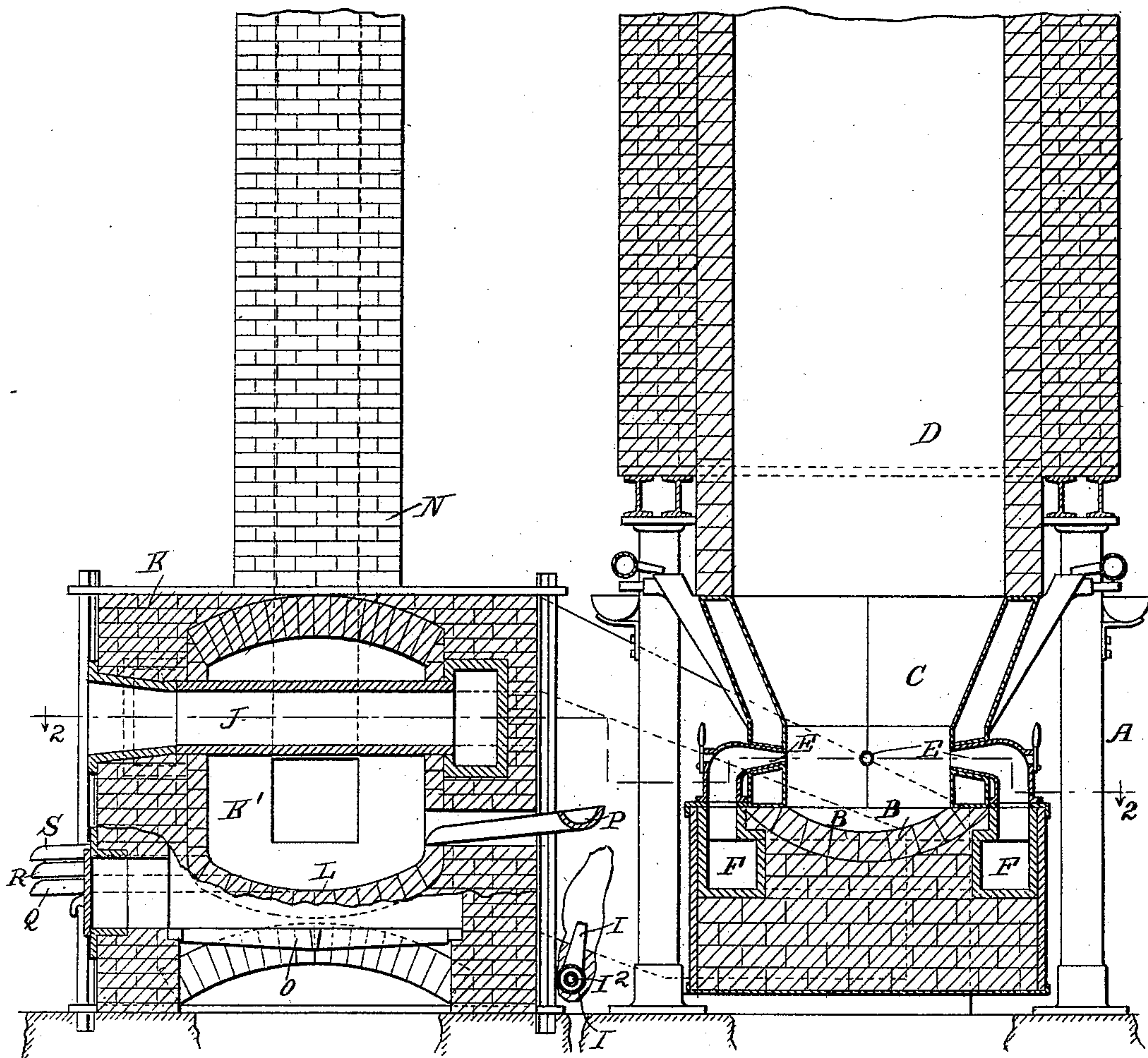
A. L. ENGELBACH & S. E. BRETHERTON.

APPARATUS FOR REDUCING AND SMELTING SULPHIDE ORES.

No. 496,250.

Patented Apr. 25, 1893.

*Fig. 1.*



WITNESSES:

*J. A. Griswell*  
*W. Sedgwick*

INVENTORS

*A. L. Engelbach*  
*S. E. Bretherton*  
*Munn & Co*

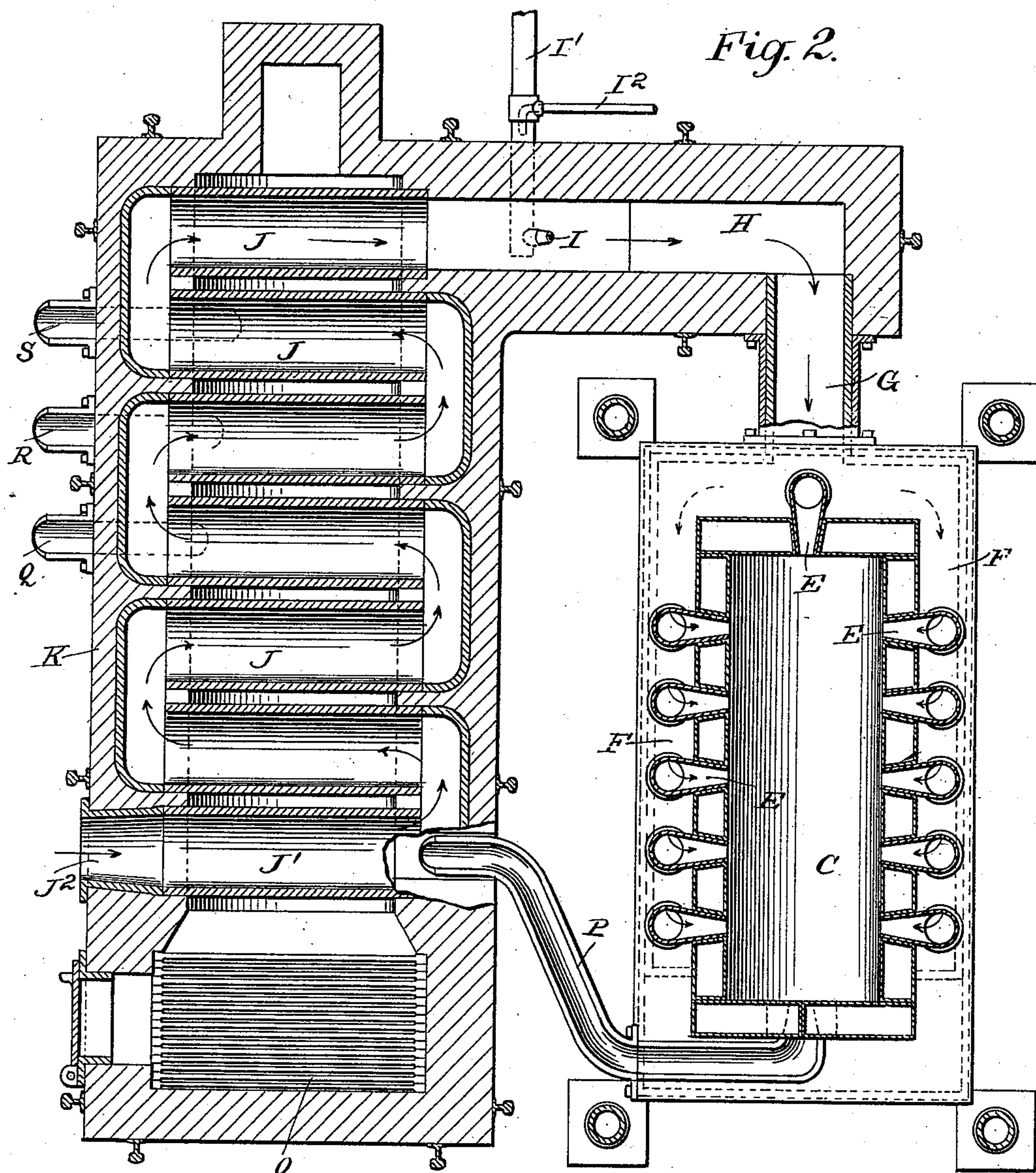
ATTORNEYS.

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*C. Sedgwick*

INVENTORS

*A. L. Engelbach*  
BY *S. E. Bretherton*  
*Munn & Co.*  
ATTORNEYS.



# UNITED STATES PATENT OFFICE.

AUGUSTUS L. ENGELBACH AND SIDNEY ELLIOTT BRETHERTON, OF LEADVILLE, COLORADO.

## APPARATUS FOR REDUCING AND SMELTING SULPHIDE ORES.

SPECIFICATION forming part of Letters Patent No. 496,250, dated April 25, 1893.

Application filed August 30, 1892. Serial No. 444,576. (No model.)

*To all whom it may concern:*

Be it known that we, AUGUSTUS L. ENGELBACH and SIDNEY ELLIOTT BRETHERTON, both of Leadville, in the county of Lake and State of Colorado, have invented a new and Improved Apparatus for Reducing and Smelting Sulphide Ores, of which the following is a full, clear, and exact description.

The invention is embodied in the construction and arrangement of the furnace, as hereinafter described, and more specifically indicated in the claims, whereby we are enabled to carry out a very efficient method, whose principal features consist in forcing air through a series of retorts which are heated by the radiating heat of the matte and slag discharged from the blast furnace, then injecting a hydrocarbon gas into the air thus heated, in order to produce an oxidizing flame, and then forcing such flame into the blast furnace to reduce the ore therein.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in both the figures.

Figure 1 is a sectional end elevation of the apparatus; and Fig. 2 is a sectional plan view of the same.

The apparatus is provided with an ordinary blast furnace A, comprising the usual crucible B, the water jackets C, arranged above the crucible and the shaft D, connected with the upper end of the water jackets. Into the latter open at all sides a series of tuyeres E, connected with a channel F, arranged within the wall of the crucible B, as plainly illustrated in Fig. 1, one end of the said channel being connected by a pipe G, with a combustion chamber H, into which passes hot air generated by a series of retorts J, as hereinafter more fully described, and into the said combustion chamber also extends a nozzle I, through which a mixture of oil and steam is introduced to mix with the hot air and be burned in the said combustion chamber H.

The oil is introduced to the nozzle I by means of a pipe I', connected with a suitable source of steam supply and into this pipe I' extends a steam supply pipe I<sup>2</sup>, connected with a suitable source of steam supply so that a hydrocarbon mixture finally issues through

the nozzle I in the combustion chamber H. The retorts J for heating the air used in the combustion chamber H are arranged within an oven K, provided with a crucible L, and having its heating chamber K, connected at its rear end with a chimney N, for drawing off the smoke and gases after the same have passed over and under the series of connected retorts J of which the first one J' is provided with a nozzle J<sup>2</sup>, for connecting the same with a suitable source of air supply, such as a blower, to force air through the series of connected retorts.

On the end of the chamber K' opposite the chimney N is arranged a furnace O, in which a fire may be kept burning for generating heat to heat the retorts J, in case a sufficient quantity of heat is not obtained from the matte and slag passing onto the crucible L and radiating its heat into the chamber K' to heat the retorts J. The crucible L is connected by the spout P, with the crucible B of the blast furnace A, so that the molten matte and slag in the said blast furnace can pass through the spout P onto the crucible L of the oven K in which the heat radiating from the said matte and slag is utilized to heat the air passing through the series of connected retorts J. From the crucible L in the oven K leads a series of spouts Q, R, S, located one above the other, so as to draw off the separated matte, slag and other substances according to their specific gravity.

The operation is as follows: When the blast furnace A is charged in the usual manner, then the heated air from the connected retorts J, passes into the combustion chamber H to mix therein with the hydrocarbon mixture issuing through the nozzle I, thus producing a gas which readily ignites in the said combustion chamber H and forms an oxidizing flame which passes through the pipe G into the channel F and from the latter to the tuyeres E into the charge of the blast furnace A, so that the heat or oxidizing flame serves to fuse the sulphide ore without the aid of carbonaceous fuel. The molten product, consisting of matte and slag, gathers on the crucible B and passes from the latter through the spout P onto the crucible L in the oven K to radiate heat in the chamber K'



to heat the retorts J, as previously described. The matte and slag separate on the crucible L and are drawn off at the proper time through the corresponding spouts Q, R, S.

5 It is understood that if other substances, as speiss for instance, are contained in the molten product, the same separates from the bullion, matte and slag and is discharged through a corresponding spout from the crucible L. If the heat radiating from the molten product in the crucible L in the oven K is not sufficient to heat the air passing through the retorts J, to say 1,000° to 1,200° Fahrenheit, then the furnace O is fired as previously described, so as to supply the deficiency. By locating the channel F which is made of iron, tin, clay or any other suitable fire-proof material, in the wall of the crucible B, no heat is lost by radiation, and at the same time but a short connection is necessary between the said channel and the interior of the blast furnace A by the tuyeres E. The heated gas in the channel F has a tendency to keep the crucible B at a high temperature so that chilling of the molten mass on the crucible is prevented.

Having thus fully described our invention, we claim as new and desire to secure by Letters Patent—

30 1. An apparatus for reducing and smelting ores, comprising a blast furnace, a channel arranged in the wall of the crucible of the said blast furnace, tuyeres connecting the said channel with the interior of the said furnace, a combustion chamber connected with the said channel, an oven containing retorts connected with the said combustion chamber, the said oven serving to heat the air passing through the said retorts, and a nozzle extending into the said combustion chamber and through which passes a mixture of steam and oil, substantially as shown and described.

45 2. An apparatus for reducing and smelting ores, comprising a blast furnace, a channel arranged in the wall of the crucible of the said blast furnace, tuyeres connecting the said channel with the interior of the said furnace,

a combustion chamber connected with the said channel, an oven containing retorts connected with the said combustion chamber, the said oven serving to heat the air passing through the said retorts, a nozzle extending into the said combustion chamber and through which passes a mixture of steam and oil, and a furnace connected with one end of the said oven, substantially as shown and described.

3. An apparatus for reducing and smelting ores, comprising a blast furnace, a channel arranged in the wall of the crucible of the said blast furnace, tuyeres connecting the said channel with the interior of the said furnace, a combustion chamber connected with the said channel, an oven containing retorts connected with the said combustion chamber, the said oven serving to heat the air passing through the said retorts, a nozzle extending into the said combustion chamber and through which passes a mixture of steam and oil, and a spout connecting the crucible of the said blast furnace with the crucible of the said oven, substantially as shown and described.

4. An apparatus for reducing and smelting ores, comprising a blast furnace, a channel arranged in the wall of the crucible of the said blast furnace, tuyeres connecting the said channel with the interior of the said furnace, a combustion chamber connected with the said channel, an oven containing retorts connected with the said combustion chamber, the said oven serving to heat the air passing through the said retorts, a nozzle extending into the said combustion chamber and through which passes a mixture of steam and oil, a spout connecting the crucible of the said blast furnace with the crucible of the said oven, and a series of outlet spouts for the separated products of the molten matter in the oven, substantially as shown and described.

AUGUSTUS L. ENGELBACH.  
SIDNEY ELLIOTT BRETHERTON.

Witnesses:  
J. W. EASTON,  
GEO. S. PHELPS.