

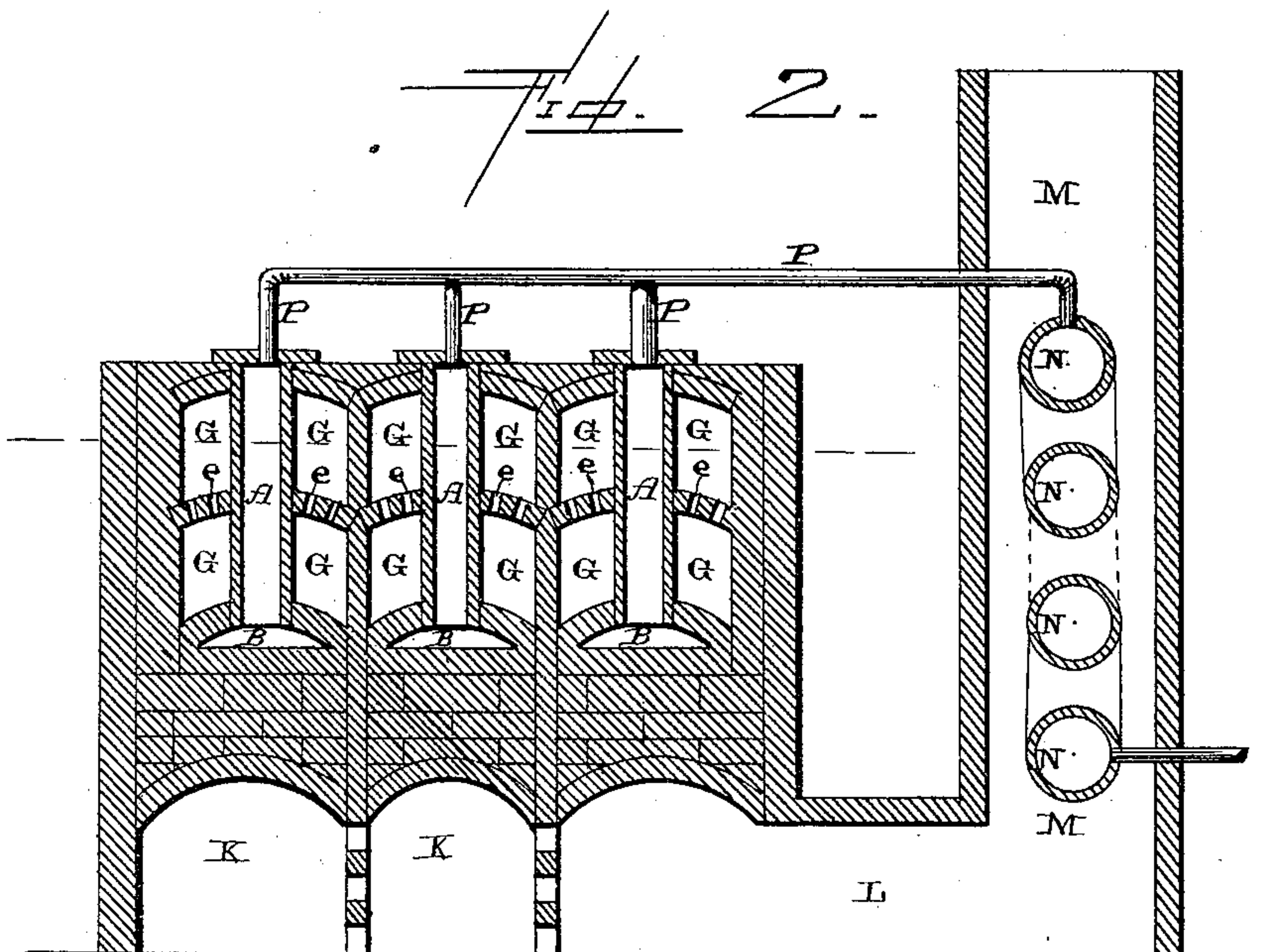
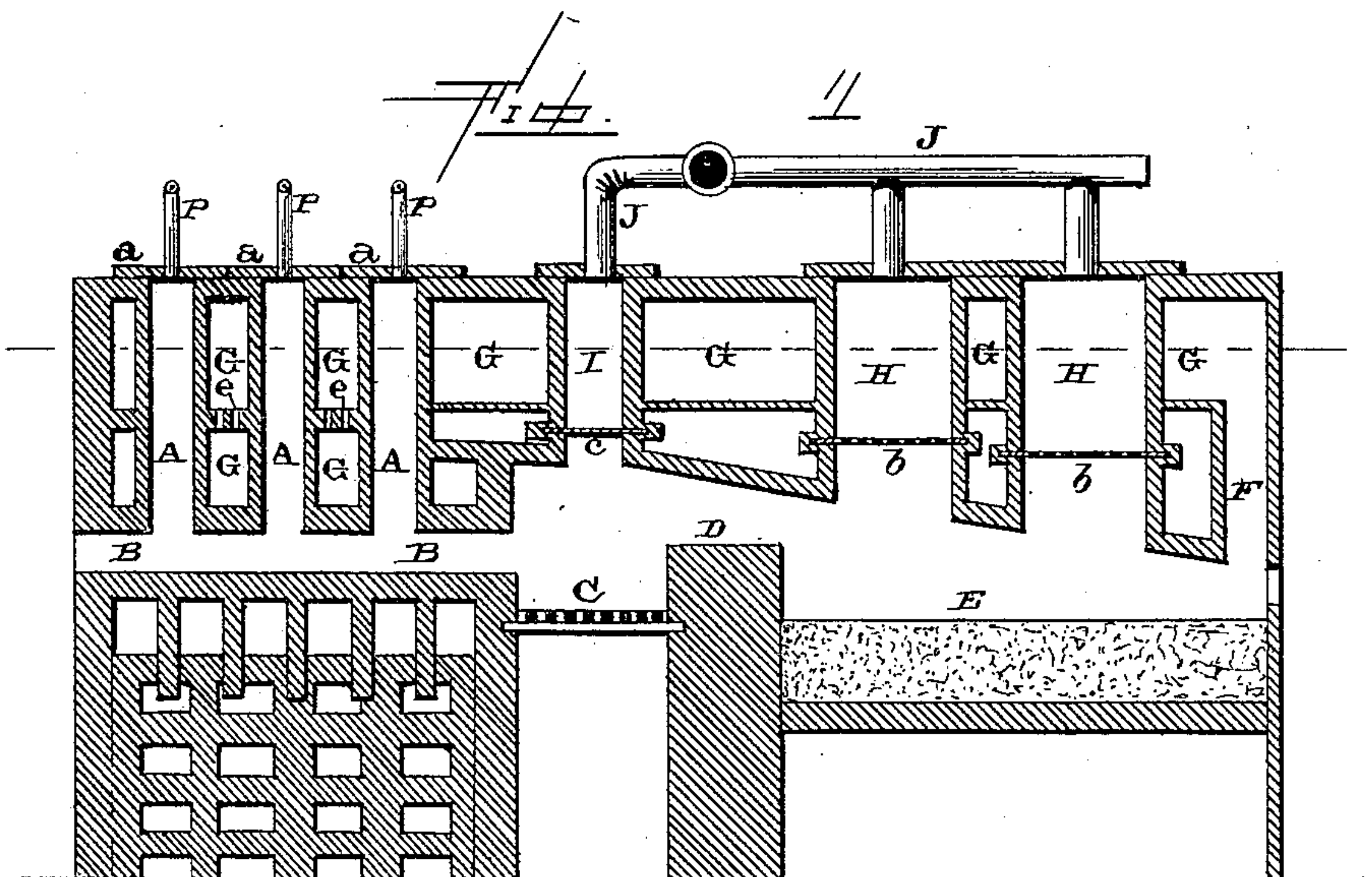
(No Model.)

2 Sheets—Sheet 1.

W. L. McNAIR.
ORE REDUCING FURNACE.

No. 368,481.

Patented Aug. 16, 1887.



WITNESSES.
R. D. Gardner
E. P. Ellis

Inventor.
W. L. McNair,
per J. A. Lehmann, atty.

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Fig. 3. 3.

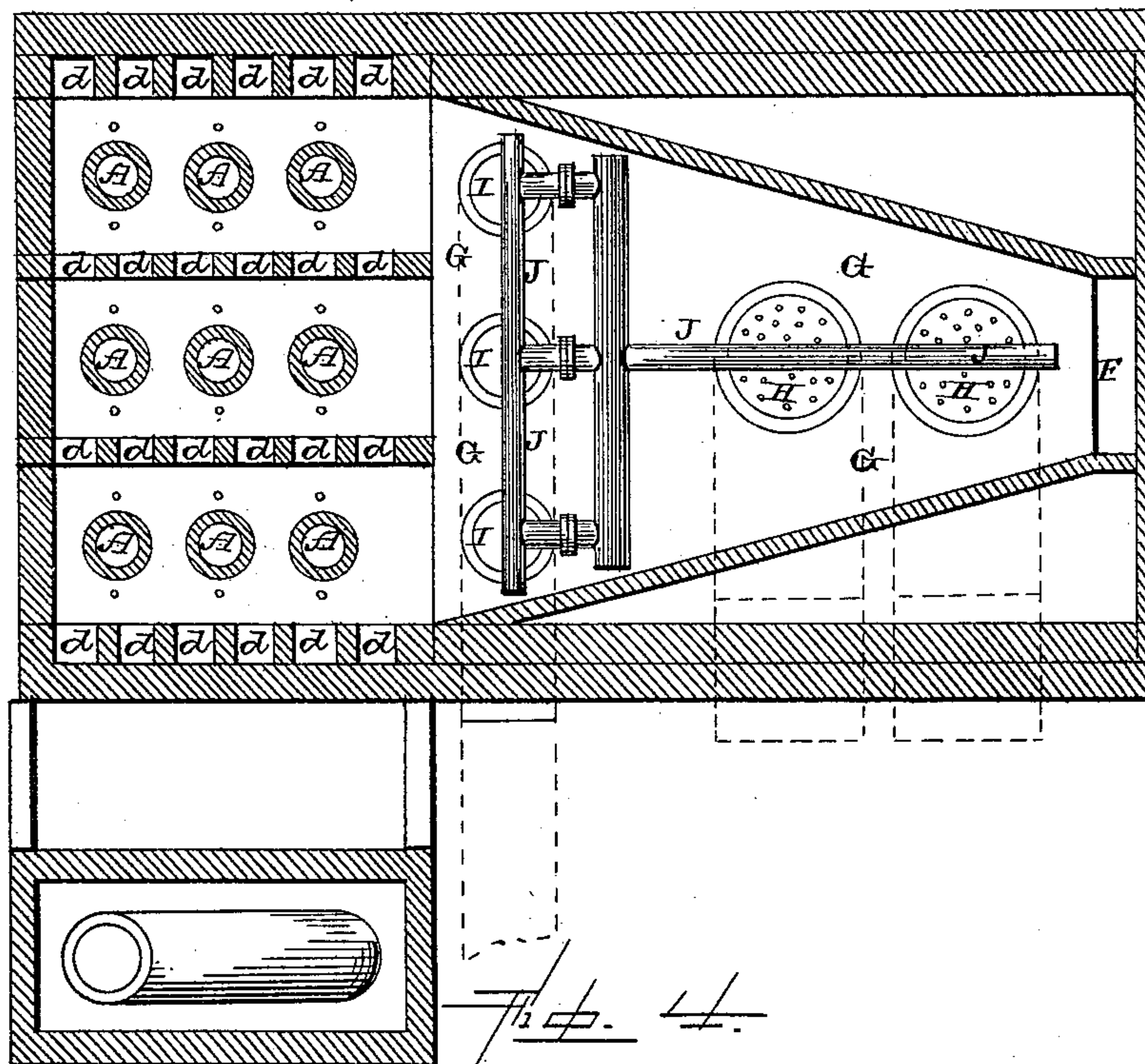
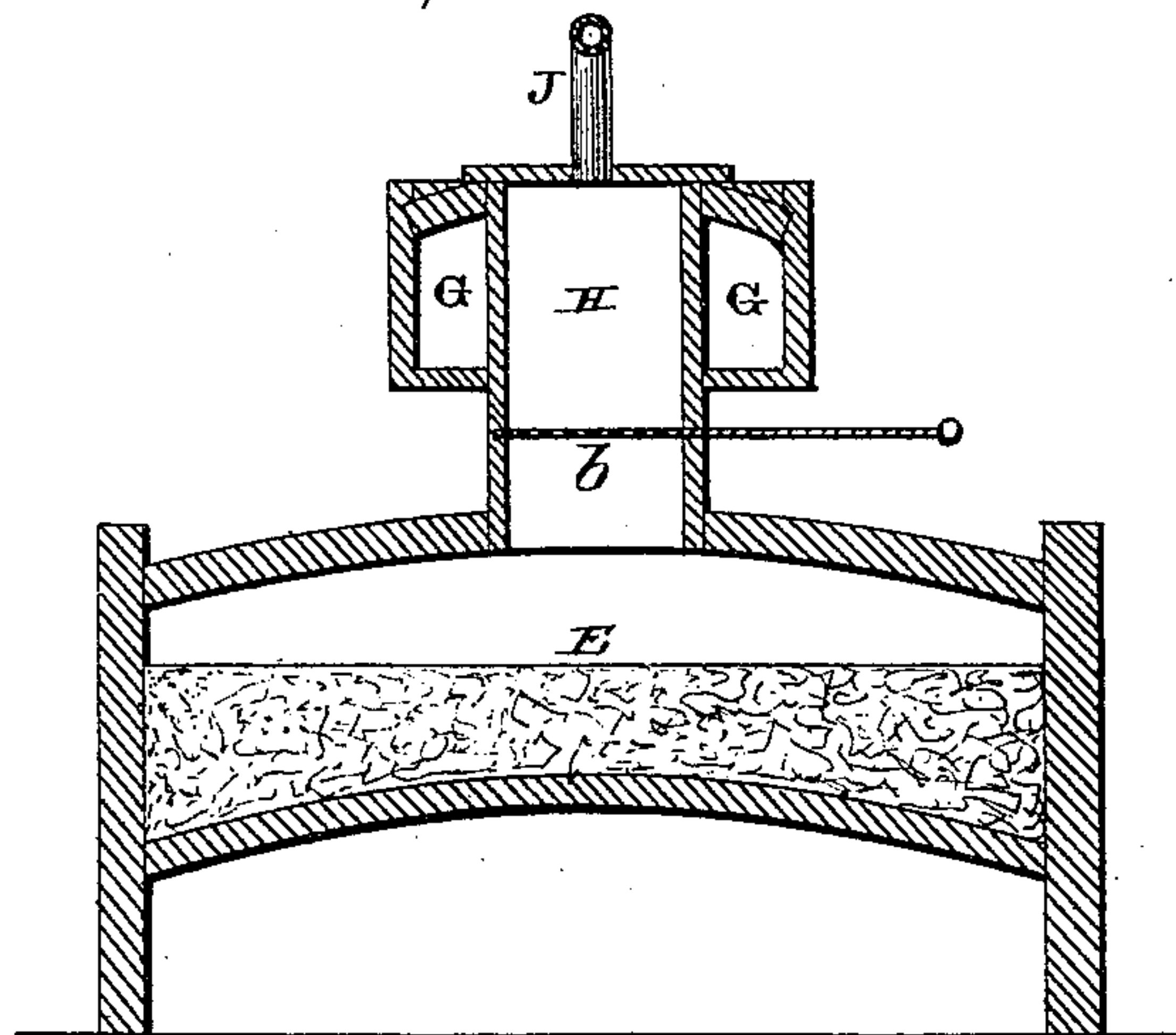


Fig. 4. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM LYON McNAIR, OF DENVER, COLORADO.

ORE-REDUCING FURNACE.

SPECIFICATION forming part of Letters Patent No. 368,481, dated August 16, 1887.

Application filed March 12, 1887. Serial No. 230,710. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM LYON McNAIR, of Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Ore-Reducing Furnaces; and I 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in ore-reducing furnaces; and it consists in the combination and arrangement of parts, which will be more fully described hereinafter, and pointed out in the claims.

Figure 1 is a vertical longitudinal section of a furnace embodying my invention. Fig. 2 is a vertical section taken at right angles with Fig. 1 and through the gas-retorts. Fig. 3 is a horizontal section taken through the horizontal gas-retorts. Fig. 4 is a vertical cross-section taken through one of the ore-retorts.

A represents the vertical retorts, in which the coal is placed to be converted into gas, and B the horizontal retorts, which run at right angles to the retorts A and which are placed just below them. As shown in Fig. 3, the retorts A are placed vertically and arranged in series, so that they can be operated alternately. Each one is provided with a cover, *a*, which can be removed for the purpose of filling the retort with coal, for the purpose of being converted into gas. As the retorts are filled the lower portion of the coal rests upon the bottom of the horizontal retort B, which opens at its inner end upon the grate C. The fresh coal is charged in at the top of the retorts A, and the distillation commences at that point. The gas, as it passes down through the mass of fuel, is constantly in contact with it, thereby increasing in heat in its descent to the horizontal retorts B. As no cold fuel is charged into the horizontal retorts, they remain at a uniform temperature, and consequently there is no variation of temperature in the gas entering the furnace. Leading into the tops of each one of the retorts A is a steam-pipe, P, which conveys steam from the steam-generator N, which is placed in the

stack M. The escaping heat, in passing through the stack M, heats the water in the generator, and the steam passes through the pipe P into the retorts A. The steam, in passing through the retorts A, becomes decomposed, as does also the steam arising from the water in the coal. The steam, in passing through the retorts, becomes converted into carbonic oxide. As the coal in the horizontal retorts B becomes thoroughly converted into coke it is pushed from the retorts upon the grate C, where it is consumed. The heat passes from the grate C over the bridge-wall D, over the hearth E, up the flue F, and then back through the flue G around the retorts H I A. This heat is made, in passing around these retorts, to distill the gas from the coal in the retorts A I, so that the gas is used for fuel in the reduction of the metal upon the hearth E.

The retorts I are located just above the grate C, and are provided with suitable bottoms, *c*, so as to hold the coal and prevent it from dropping upon the grate beneath until the coal has been thoroughly converted into coke. As the gas passes from these retorts I it enters the retorts H through the pipe J. This gas then passes downward through the retorts H, in which the ore is placed, and through the perforated bottoms *b* to the hearth beneath. After the coal in the retorts I has been thoroughly coked the slides or bottoms *c* are withdrawn, so that the coke is discharged upon the grate below, where it is consumed.

The retorts H are to be filled with ore. It is first broken up to the proper size, and is held supported above the hearth by means of the perforated bottoms or gates *b*. When the ore becomes thoroughly deoxidized in these retorts, the gates *b* are withdrawn and the charge let drop upon the hearth E, where it may be converted into open-hearth steel, or it may be heated and hammered into a bloom, as may be preferred. The advantages of using gas as a reducing agent are that none of the earthy impurities of the fuel come in contact with the ore, nor do they become mechanically mixed with the metallic sponge, as is the case when solid fuel is used as a reducing agent. In order to keep up the constant supply of gas, the retorts A B are charged alternately, and in the same manner the retorts I are charged alternately. By working these re-

torts in this manner a fresh supply of gas is supplied from the second series of retorts before the supply from the first has become exhausted. The fuel used in the retorts A may
5 be fine slack; but the coal placed in the retorts I should be good clean coal. The waste products of combustion, passing around and heating the retorts H I A, then pass down
10 around the retorts A, through the ports *d* (shown in Fig. 3) into the chambers K, underneath the retorts B, and from there through the flue L up the stack M. As the temperature
15 is very high, the products of combustion are correspondingly high when they leave it. Thus it will be seen that by the construction here shown a very large proportion of the heat that
20 would otherwise be wasted is made to do useful work. By properly preparing the fuel and heating the charges of ore by the waste heat of the furnace to a uniform temperature, a degree of uniformity can be maintained in the
25 furnace that could not otherwise be done. It also insures the maximum temperature from the minimum amount of coal.

Having thus described my invention, I claim—

30 1. The combination of the vertical retorts A, the horizontal retorts B, located under the retorts A, the grate C, hearth E, and the flues F G, which convey the products of combustion around the retorts for the purpose of heating their contents, with the steam-generator lo-

35 cated in the stack, and the pipe T, for conveying the steam to the vertical retorts, substantially as described.

2. The combination of the grate C, the hearth E, with the vertical retorts H placed above the hearth, and the flues F G, which convey
40 the products of combustion around the retorts for the purpose of heating their contents, and the perforated slides *b*, which support the contents of the retorts, substantially as described.

3. The combination of the grate C, the hearth
45 E, the vertical ore-retorts H, placed above the hearth E and provided with perforated bottoms, with the gas-retorts I, the pipes J, for conveying the gas from the retorts I to the
ones H, and the flues F G, for the products of
50 combustion, substantially as specified.

4. The combination of the vertical retorts A, the horizontal retorts B, the horizontal retorts located under the vertical ones A, the grate C, the hearth E, the flues F G, which
55 carry the products of combustion around all of the retorts, the vertical ore-retorts located above the hearth, the gas retorts located above the grate, the passages *e d* through the brick-work around the retorts A, the chambers K
60 under the horizontal retorts, the flue L, and the stack, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM LYON McNAIR.

Witnesses:

JOHN T. WESTBREC,
WALTER WILSON.