

(No Model.)

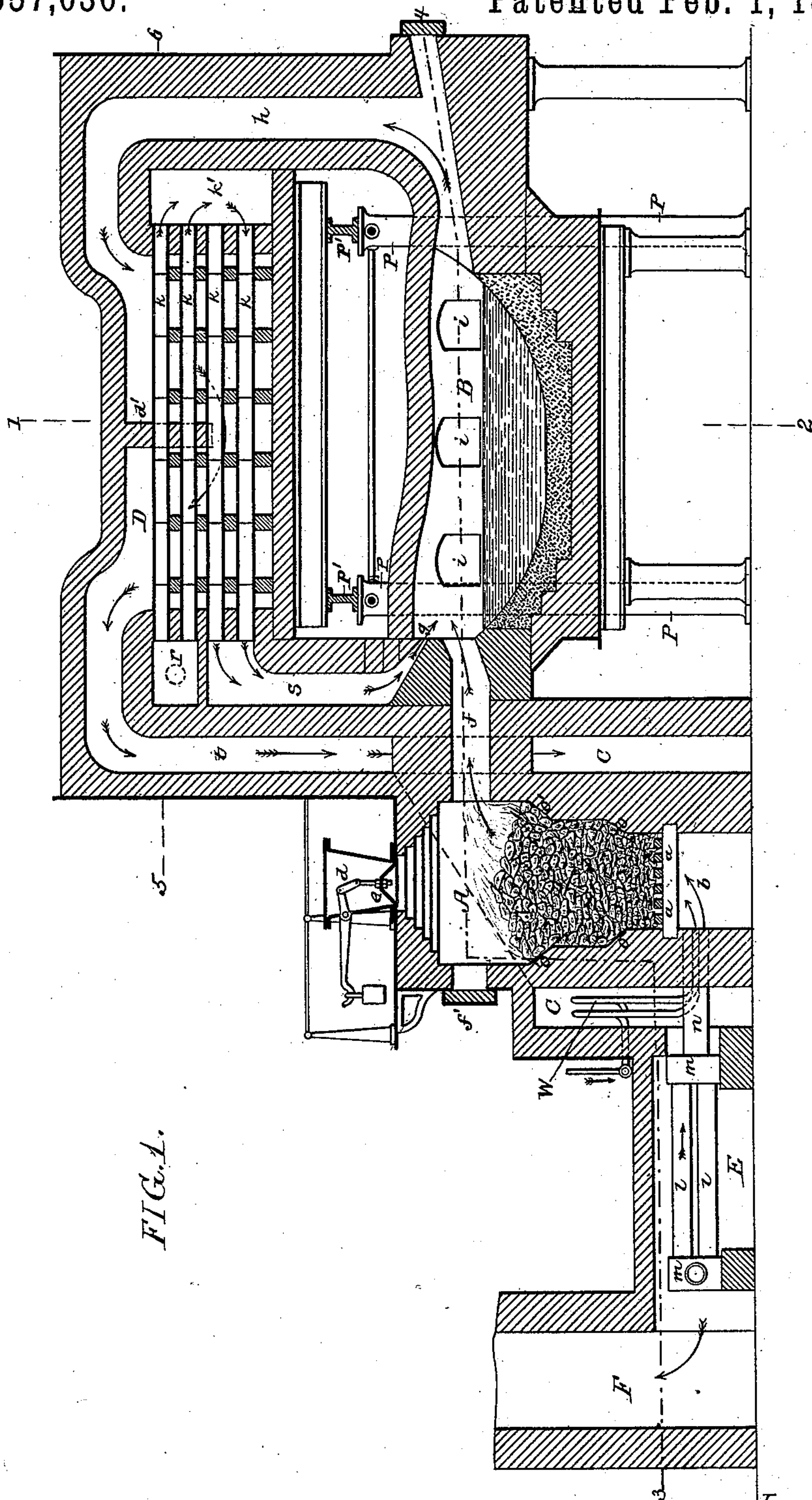
3 Sheets—Sheet 1.

F. RADCLIFFE.

GAS FURNACE.

No. 357,030.

Patented Feb. 1, 1887.



Witnesses:  
Alex. Barkoff  
John E. Parker

Inventor:  
Francis Radcliffe  
by his Attorneys  
Howson & Sons

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FIG. 4.

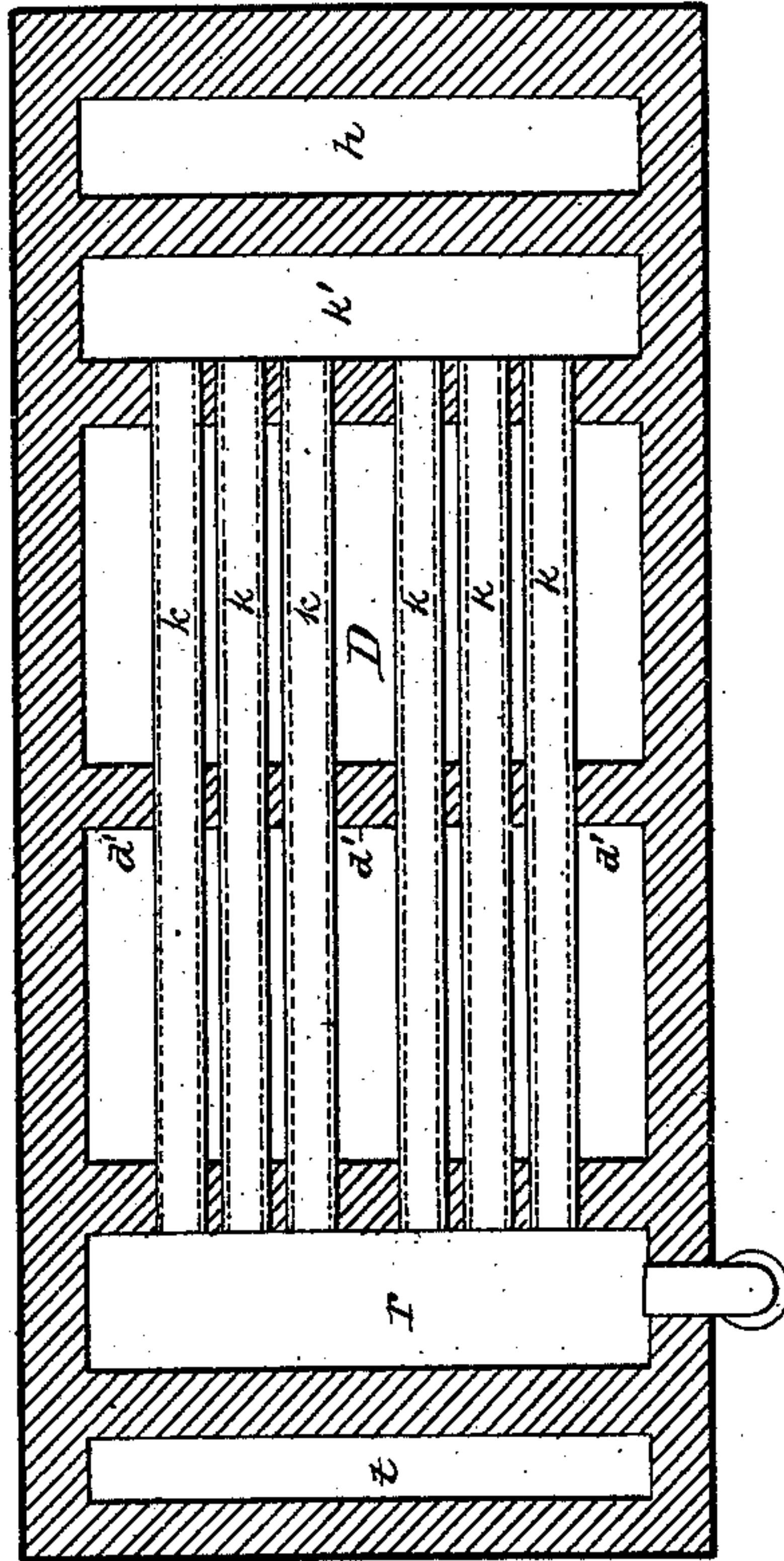
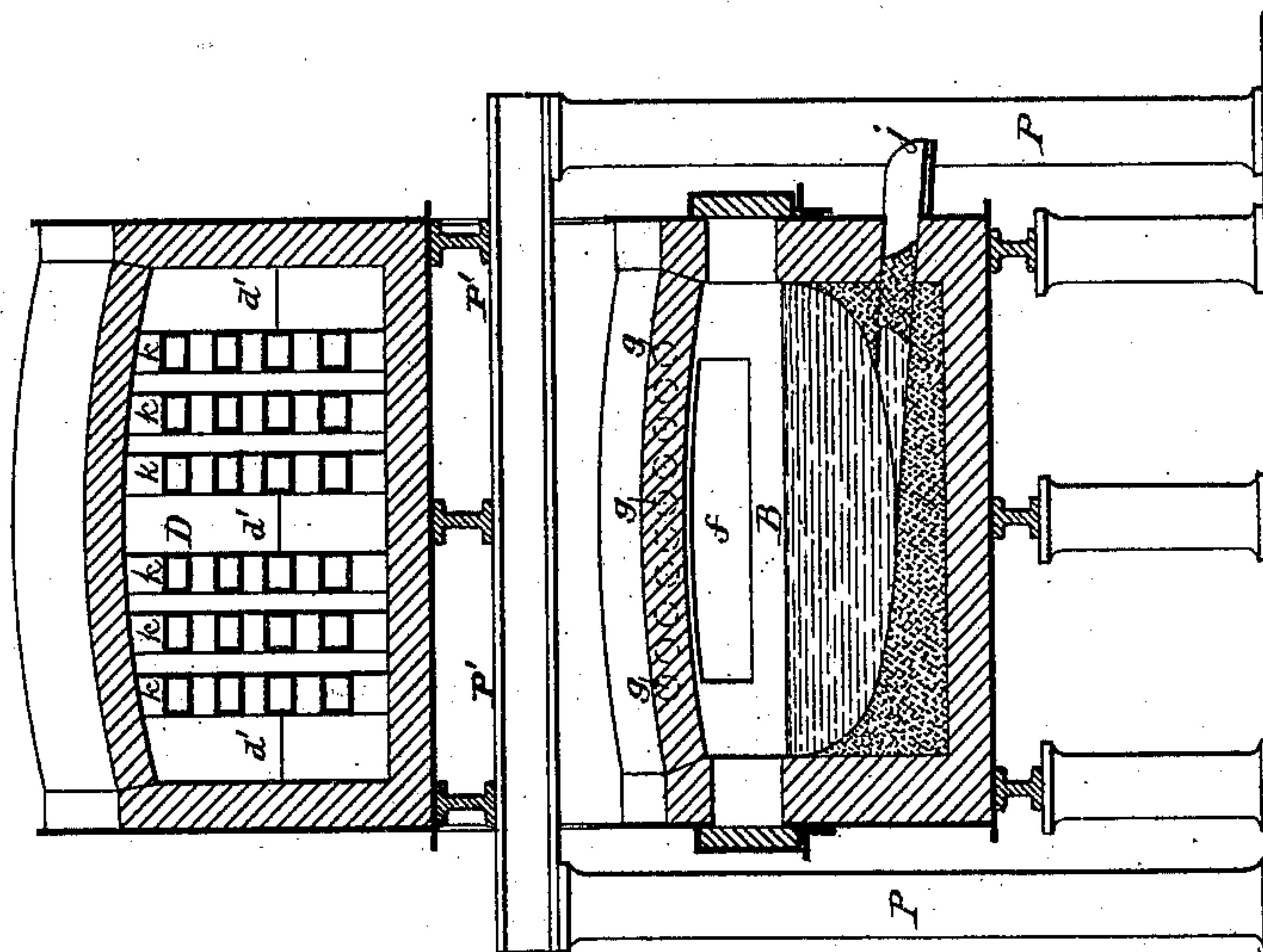


FIG. 2.



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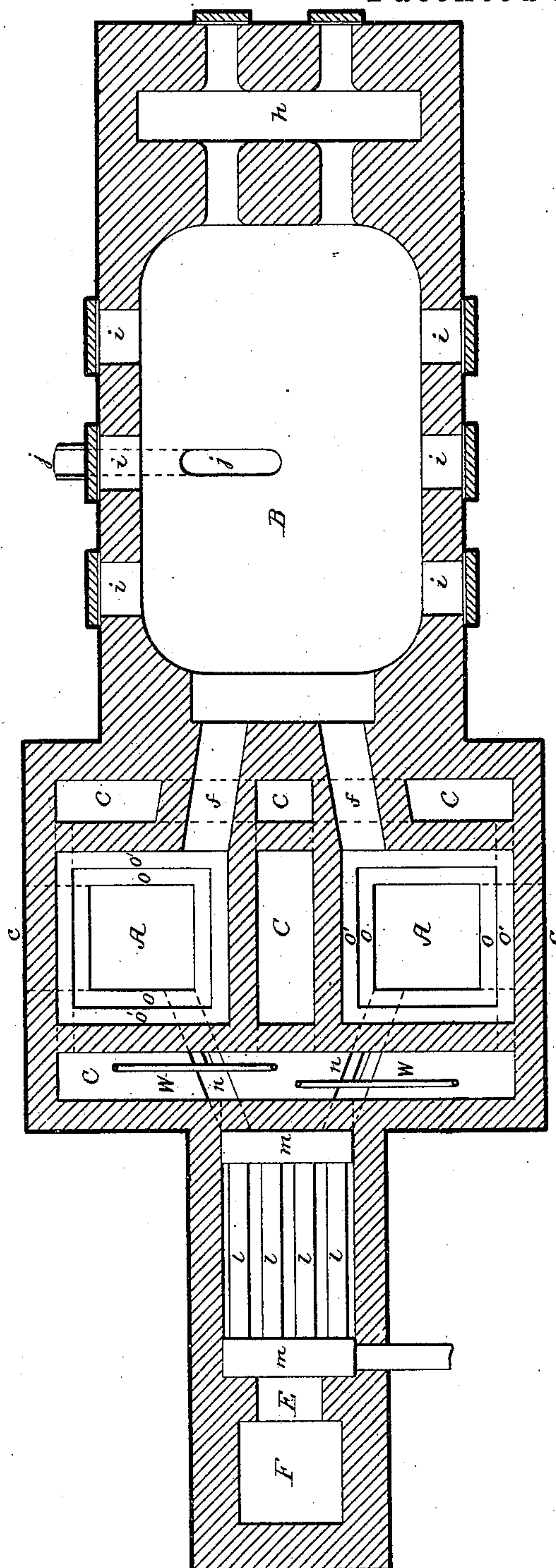
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FIG. 3.



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# UNITED STATES PATENT OFFICE.

FRANCIS RADCLIFFE, OF PLUMSTEAD, COUNTY OF KENT, ASSIGNOR TO HENRY ARTHUR GADSDEN, OF LONDON, ENGLAND.

## GAS-FURNACE.

SPECIFICATION forming part of Letters Patent No. 357,030, dated February 1, 1887.

Application filed January 11, 1886. Serial No. 188,232. (No model.) Patented in England December 3, 1884, No. 15,880.

*To all whom it may concern:*

Be it known that I, FRANCIS RADCLIFFE, of 22 Crescent Road, Plumstead, county of Kent, England, have invented certain Improve-  
5 ments in Gas-Furnaces, (for which I have obtained British Letters Patent No. 15,880, dated December 3, 1884,) of which the following is a specification.

The main object of my invention is to so  
10 construct a furnace for metallurgic and other uses in which a gas-producer is combined with a melting or combustion chamber that the highest heating efficiency will be obtained with the most economical use of fuel, and  
15 this object I attain in the manner which I will now proceed to describe.

In the accompanying drawings, Figure 1 is a vertical section of my improved furnace as constructed for the melting of iron and steel.  
20 Fig. 2 is a transverse section on the line 1 2, Fig. 1. Fig. 3 is a sectional plan view on the line 3 4, Fig. 1; and Fig. 4 is a sectional plan view on the line 5 6, Fig. 1.

The main parts of my furnace comprise the  
25 gas-producers A, communicating through flues *f* with the melting or combustion chamber B, which in turn communicates through a flue, *h*, with the air heater or regenerator D above the melting or heating chamber, and  
30 communicating with the latter through suitable apertures, *g*, which furnish the heated air to combine with the gas from the producers to obtain the necessary combustion. The smoke-  
35 flues of the regenerator communicate with flues C, surrounding the gas-producers and opening into the enlarged flue E, containing the air-blast-heating devices for the air to be supplied to the gas-producers, and also opening into the chimney or stack F, as illustrated in Fig. 1.

40 Each of the gas-producers A is provided with suitable fire-bars *a*, and below the latter ash-pits *b*, with closed doors *c*, Fig. 3, at the sides to remove the ashes. At the top of each producer is a suitable feed-hopper, *d*, for sup-  
45 plying the fuel, and closed by a bell, *e*, in any usual manner.

In addition to the usual bosh *o*, formed in the walls of the producer above the grate, I prefer to form a second bosh, *o'*, below the exit-  
50 flue *f*, for the double purpose of holding up the fuel and preventing any air from working its

way up the side walls of the producer and burning or vitiating the gases produced.

In the wall of the producer opposite the exit-  
flue *f*, I form an opening, *f'*, closed by a suitable  
55 door, to permit of access to the interior of the producer and to the said flue when desired.

I prefer to construct the flues so that they will communicate with each other and open  
into the melting or heating chamber B, as illus-  
60 trated in Fig. 3, and to turn the end of the flue upward and slightly contract it, as illustrated in Fig. 1, so that the jets of air entering through the openings *g* immediately above the  
65 flue will strike the stream of gas nearly at right angles and more thoroughly mix therewith to produce a complete ignition and combustion  
in the chamber B, on the hearth of which is contained the metal, glass, or other material  
70 to be melted or heated. The side walls of this melting-chamber of the furnace are provided with suitable closed doors, *i*, and with a tapping-spout, *j*.

The products of combustion from the cham-  
ber B pass through the upright flue *h* at the  
75 opposite end to the air-heater D, which I prefer to arrange above the melting-chamber, for convenience of access for repairs and in order to lessen the liability of dust passing over with  
the products of combustion from the melting-  
80 chamber and choking up the flues. The structure of the air-heater, however, is supported on pillars P and cross-bars P', and is independent of the melting-chamber.

The air-heater is composed of a number of  
85 tubes, *k*, preferably of the rectangular section illustrated in Fig. 2, and supported by convenient brick-work, all the tubes communi-  
cating at one end with a common flue, *k'*, while at the other end one-half the tubes open out  
90 from an air-inlet flue, *r*, and the other tubes open into the down flue *s*, with its openings *g* leading into the combustion-chamber above the gas-flues *f*. As will be seen on reference  
95 to Fig. 1, I prefer to make these tubes in short sections and to arrange the brick-work above referred to, where the joints occur, as illustrated in said figure, so that the brick-work  
will not only support the tubes, but also pro-  
100 tect the joints. By this construction the air under pressure entering at *r* will pass through the upper set of tubes, *k*, to the common flue



$k'$ , and thence return through the lower set of tubes to the down-flue  $s$ , leading to the combustion-chamber, although the reverse direction may be adopted if deemed preferable.

Ample space is left between the tubes  $k$  for the circulation of the products of combustion from the melting-chamber, and a bridge,  $d'$ , is formed midway of the air-heater for inducing the better circulation of the products of combustion around the tubes, to more thoroughly heat the latter and the air passing through them; or a series of bridges so disposed as to cause the products of combustion to take a circuitous course may be used if desired.

The products of combustion after leaving the air-heater  $D$ , where they are partially deprived of their heat, pass down through the flue  $t$  to the flues  $C$ , surrounding the gas-producers  $A$ , the object of this being to utilize the heat of the products of combustion to heat the walls of the gas-producer and facilitate the production of gas therein. From these flues  $C$  opens a flue,  $E$ , communicating with the smoke-stack  $F$ , by which a draft may be obtained.

It will thus be seen that the gas-producers are arranged between the furnace proper or melting-chamber and the smoke-stack, and the flues around and between the producers form a communication between the smoke-flues from the melting or heating chamber and the smoke-stack.

In the flue  $E$ , I arrange suitable piping  $l$  and communicating boxes  $m$ , for heating the air-blast introduced therein, and passing through tuyeres  $n$  into the ash-pits of the producers.

In the flues  $C$ , I prefer to also provide super-heating steam-coils  $W$ , having nozzles opening into the tuyeres  $n$ , for the introduction of steam, as well as air, below the grates of the producers.

I am aware that gas-producers and furnaces have been combined with regenerators or heating-chambers, so that the products of combustion on their way to the chimney heat the incoming air introduced through the pipes—as, for instance, in the patent of Chubb, No. 64,947, May 21, 1867. I am also aware that it

has been proposed to construct a furnace in which the flues for the passage of the products of combustion on their way to the chimney have been constructed around the gas-producing chambers. I therefore do not claim these devices, broadly, my improvements consisting in the novel combination of parts going to make up a compact, economical, and practicable furnace.

I claim as my invention—

1. The combination of a gas-producer and melting or heating chamber, flues for the products of combustion leading from the melting or heating chamber, a series of air-heating tubes passing through said flues, part of said air-tubes being open at one end to an air-supply, and part to an air-flue,  $s$ , leading to the combustion-chamber adjacent to the gas-flue of the producer, while the air-tubes at the opposite end open into a common flue,  $k'$ , and a bridge or bridges being constructed around the tubes in the flue, all substantially as set forth.

2. The combination of the gas-producer and chimney with flues for the products of combustion leading from the melting or heating chamber to the chimney, and containing, first, air-heating tubes for the melting or heating chamber; second, the gas-producer, around or through which the flues pass, and, third, pipes for heating the air-blast for the gas-producer, all substantially as set forth.

3. The combination of the melting or heating chamber, flues for the products of combustion therefrom containing air-heating tubes, a smoke-stack, and a flue,  $E$ , containing the air-blast-heating pipes for the producer, with a gas-producer between the melting or heating chamber and flue  $E$ , around or through which gas-producer the products of combustion pass on their way to the stack, substantially as specified.

Dated this 17th day of September, 1885.

FRANCIS RADCLIFFE.

Witnesses:

WM. STONE,

JAMES A. HERRICK.