

No. 609,306.

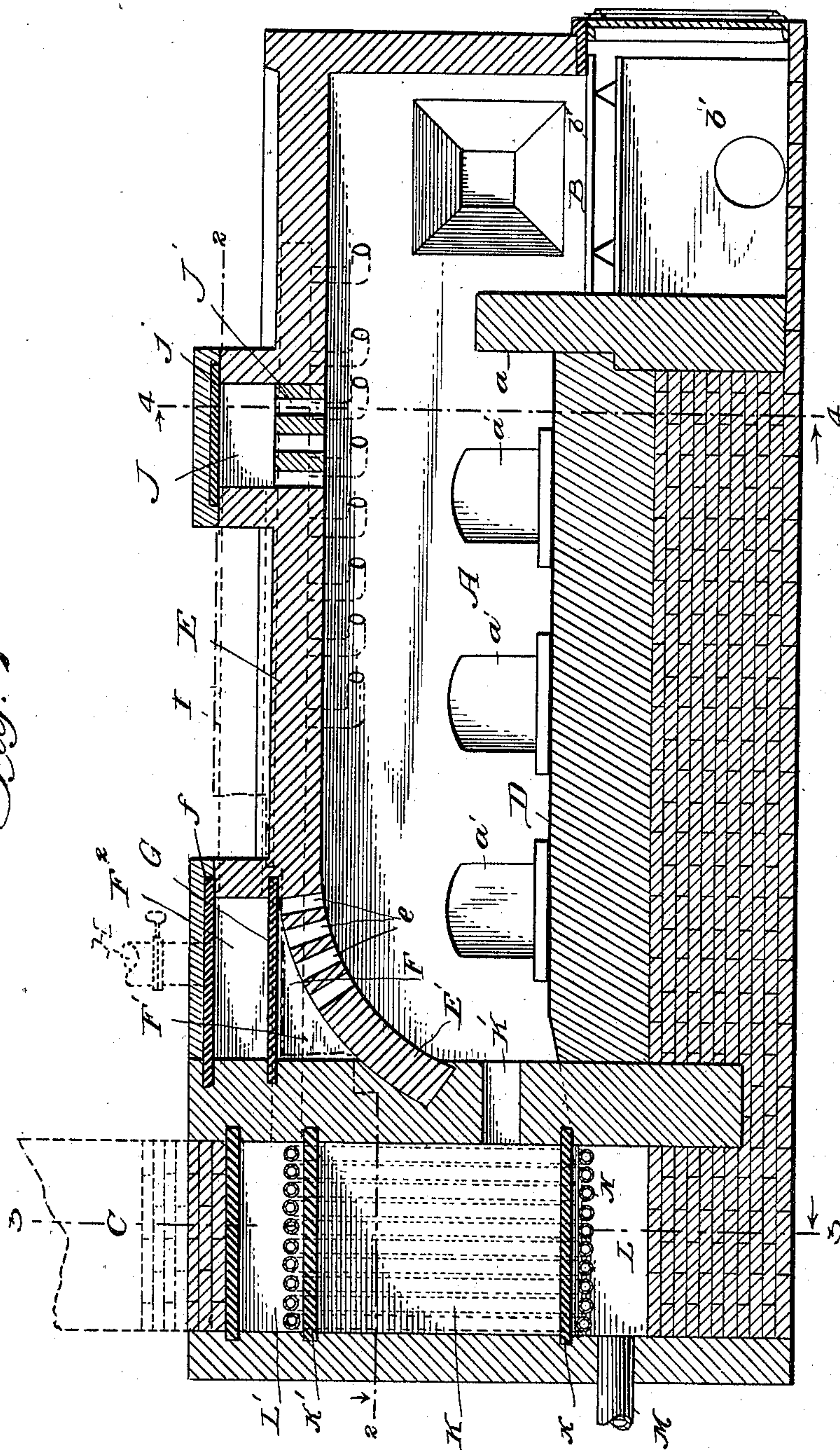
Patented Aug. 16, 1898.

W. STUBBLEBINE.
AIR HEATER FOR FURNACES.

(Application filed Jan. 26, 1897.)

(No Model.)

2 Sheets—Sheet 1.



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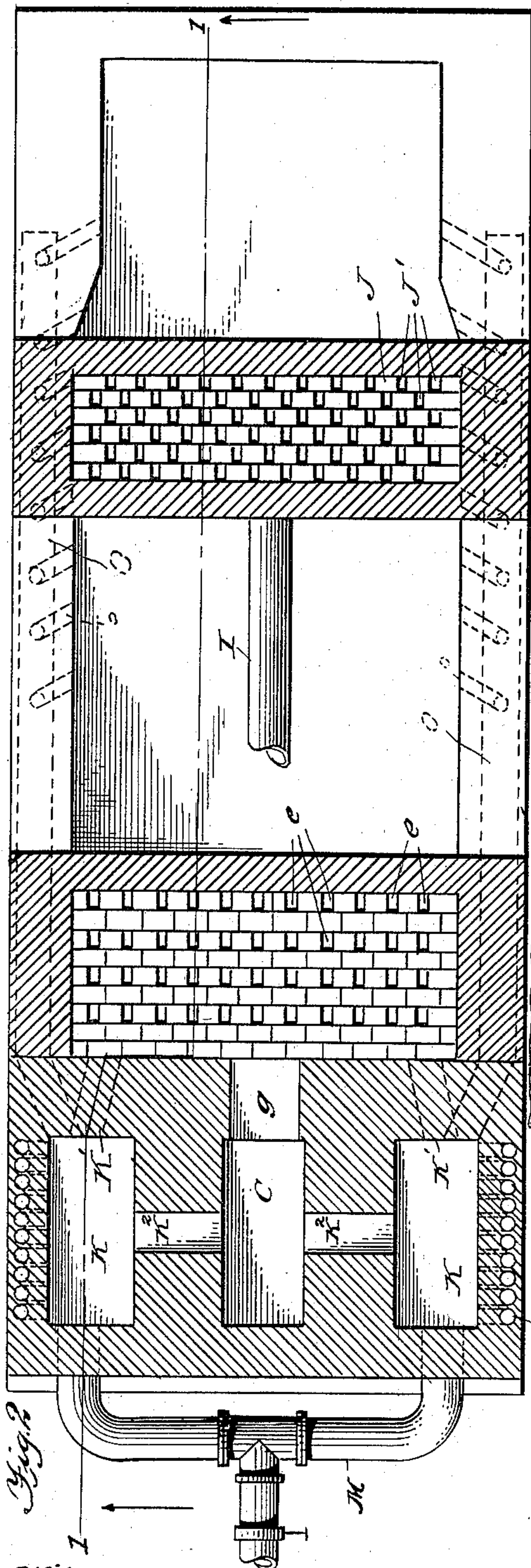
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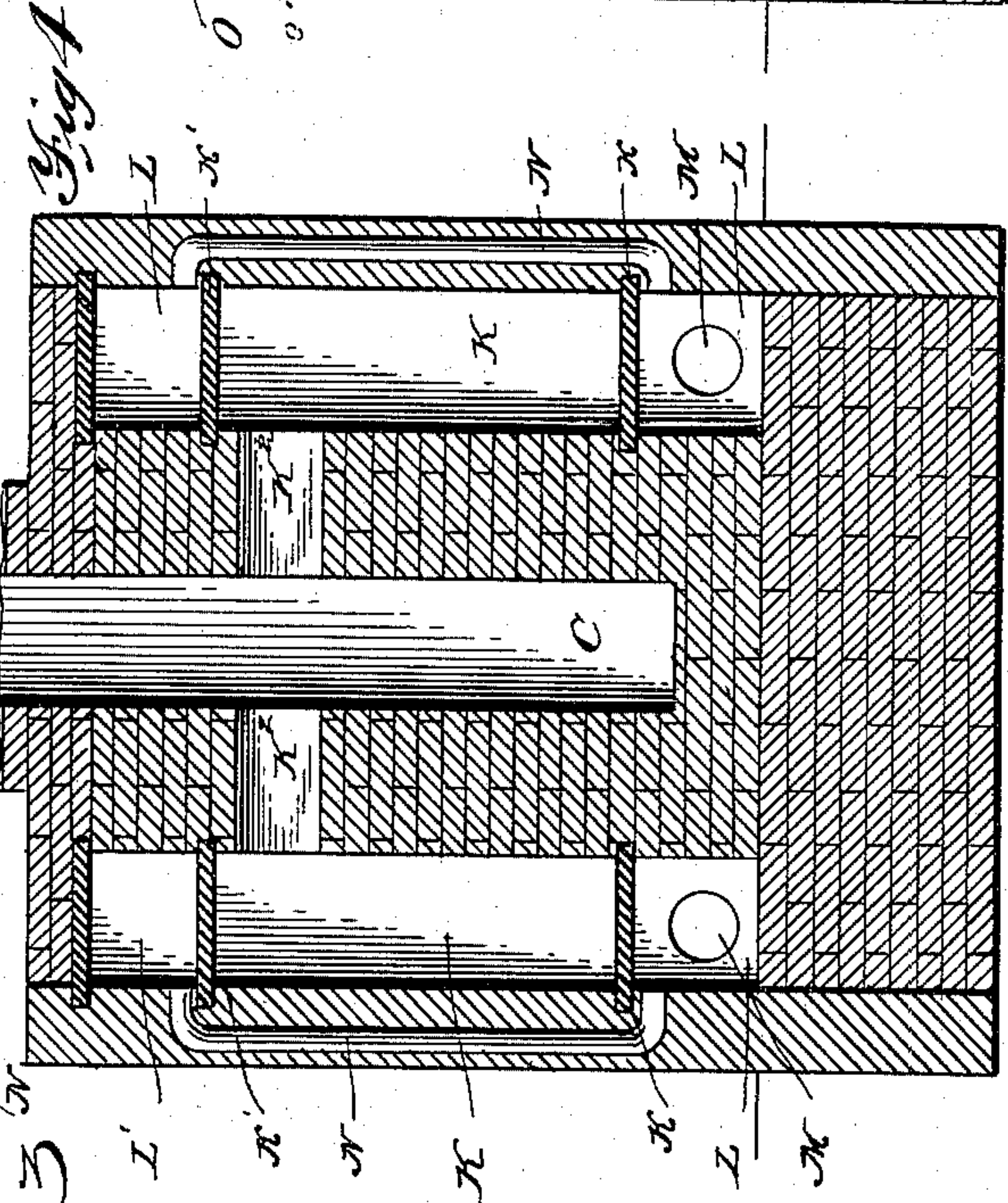
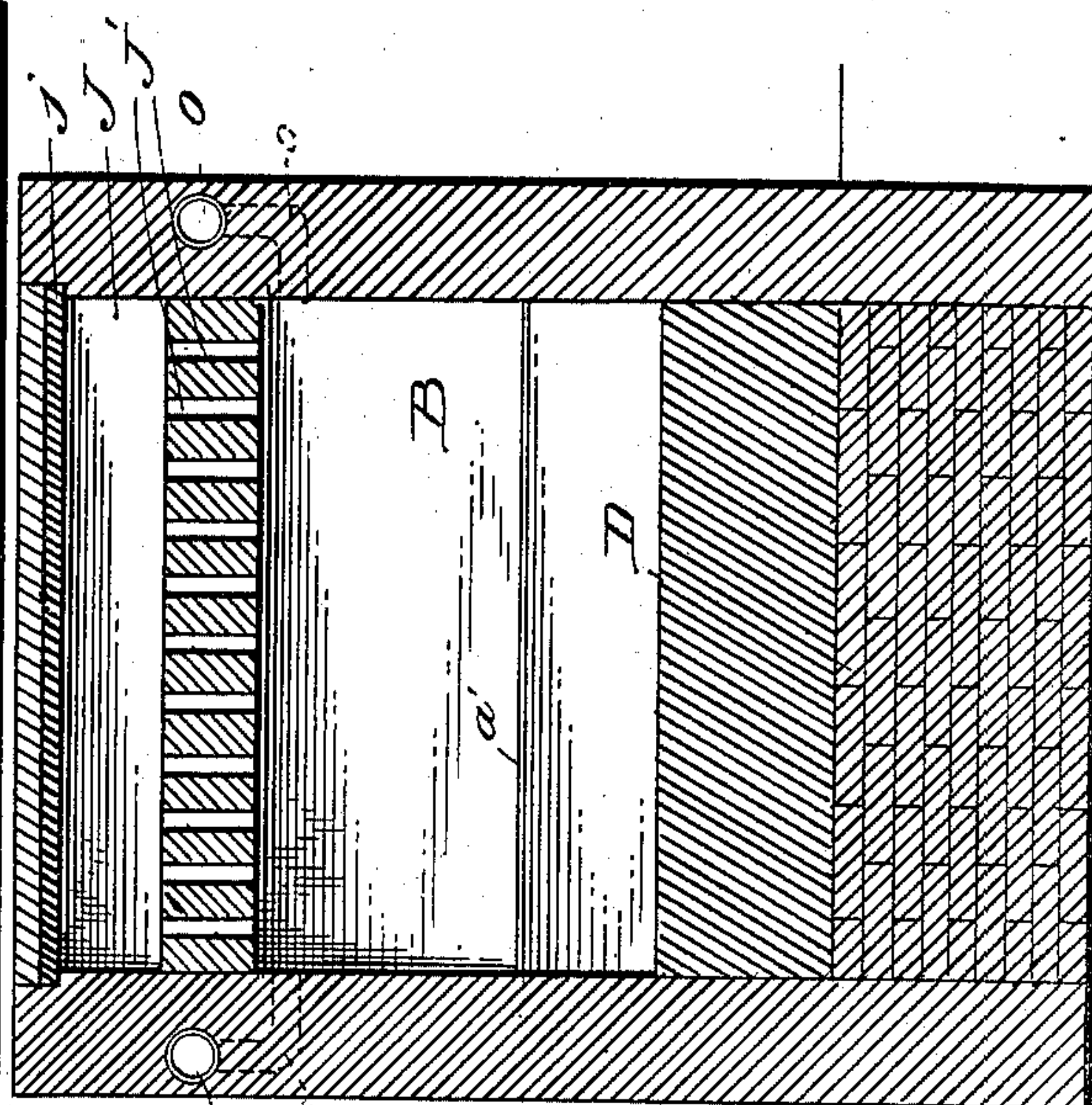
(Application filed Jan. 26, 1897.)

(No Model.)

2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

WILLIAM STUBBLEBINE, OF BETHLEHEM, PENNSYLVANIA.

AIR-HEATER FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 609,306, dated August 16, 1898.

Application filed January 26, 1897. Serial No. 620,816. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STUBBLEBINE, a citizen of the United States, residing at Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Air-Heaters for 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 appertains to make and use the same.

My invention relates to improvements in the means for heating the air-blast in reverberatory and regenerative furnaces especially adapted to metallurgical operations; and the object that I have in view is to provide a simple arrangement to utilize the waste gases from the working chamber for economically heating the large volumes of air required to be forced into the furnace for properly treating the metal in the working chamber.

The first part of my invention relates to the novel construction and arrangement of the furnace in a way to utilize parts of the furnace structure in connection with air-blast heaters situated on the roof of the furnace. That part of the roof over the working chamber adjacent to the stack is arched or carried downward and provided with a multiplicity of inclined ports for the escape of the gases and heat from the working chamber, and over this arched or curved part of the roof is erected a preliminary blast-heating chamber, which contains a heating medium, such as a heavy metallic plate or fire-brick, that divides and partitions off the preliminary heating-chamber into upper and lower compartments, in the lower of which chambers are delivered the waste heat and gases from the working chamber, from whence they pass through a port or neck into the stack or uptake of the furnace. The upper compartment of this preliminary heating-chamber has a cold-blast pipe connected thereto, in which the air is heated and expanded before it is conducted through a hot-blast pipe that leads to a delivery-chamber situated on the roof of the furnace nearly over the bridge-wall, from which delivery-chamber the hot blast passes into the working chamber through ports provided in the roof of the furnace.

The second part of my invention relates to

an improvement upon the heating devices disclosed in prior Letters Patent Nos. 456,663 and 498,089, granted to me on July 28, 1891, and May 23, 1893, respectively, in which I have shown the rear or stack wall of the furnace provided with chambers which are subdivided into upper and lower blast-compartments and a middle gas-circulating compartment, with air-pipes extending through said middle circulating-compartment and connected to the upper and lower air-compartments. In my present improvement I leave this middle circulating-compartment, which connects through passages with the working chamber and the stack, free and unobstructed by the air-pipes, and these air pipes or flues are built in or embedded into the walls of the chamber and have elbows at their ends which are connected to the upper and lower air-compartments, whereby the furnace-walls serve to protect the air-heating pipes from direct contact with and the deteriorating action of the hot gases from the working chamber; and the invention further consists in the novel construction and arrangement of devices which will be hereinafter fully described and claimed.

To enable others to understand my invention, I have illustrated the same in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a vertical longitudinal sectional elevation of a furnace embodying my invention, the plane of the section being indicated by the dotted line 1 1 of Fig. 2. Fig. 2 is a sectional plan view of the furnace, the plane of section being taken on the irregular line 2 2 of Fig. 1. Fig. 3 is a vertical transverse sectional elevation through the rear or stack wall of the furnace on the plane indicated by the dotted line 3 3 of Fig. 1. Fig. 4 is a vertical transverse sectional view on the line 4 4 of Fig. 1.

Like letters of reference denote corresponding parts in all the figures of the drawings.

I will now proceed to describe the embodiment of my invention shown by the drawings, in which—

A B designate the working and combustion chambers, respectively, with the intervening fire-brick bridge-wall *a*.

C is the stack or uptake, and D is the bed

of the working chamber. The working chamber has the usual working doors a' , and in the combustion-chamber is provided the grate b , an air-blast inlet b' , and the usual doors.

5 E is the roof of the furnace, which lies in a substantially horizontal plane over the combustion-chamber and over the major portion of the working chamber; but that part of the roof adjacent to the stack or uptake C is
10 curved or extended in a downward direction to produce the arch E' . Over this arched end of the roof is erected the heating-chamber F, preferably built up of brick or masonry and having its rear end formed by the
15 rear or stack wall of the furnace. The top of this chamber F is of brick, within which is a heavy metallic plate f , and said chamber F is divided into two parts F' F^2 by a horizontal partition G, which may be of brick or
20 a heavy metallic plate, the latter being preferred because it is adapted to be highly heated. This partition G lies in the plane of the roof E and over the arch E' , and the chamber F' is thus formed by the arch, the rear
25 stack wall, and the partition G. This lower chamber is a gas and heat circulating chamber, to which are admitted the waste gases and heat from the working chamber through the series or multiplicity of ports e , which
30 are provided in the arch E' , as shown by Figs. 1 and 2. From this circulating-chamber F' leads the port or neck g , which extends to the uptake, and thus the waste heat and gases from the working chamber are caused
35 to pass through the ports e , then circulate in the chamber F' , then pass through the neck or port g , and thence escape into the uptake. The heavy metallic plates f G in the chamber F and the walls of the chamber itself become highly heated by the hot waste gases
40 and heat from the working chamber, and thus the cold blast supplied from the pipe H is heated in the chamber F^2 preliminary to passing through the hot-blast pipe I into the delivery-chamber J.
45

The upper chamber F^2 has its top and bottom formed by the metallic plates f G, and said chamber forms an air-blast-heating chamber for the cold blast which is delivered
50 thereto by the cold-blast pipe G' , having a suitable regulating-valve. From the side of this blast-chamber F^2 leads the hot-blast pipe I, which extends horizontally above the roof E to the delivery-chamber J. This chamber
55 J is of brick or metal, erected on the roof at a suitable point over the working chamber A; but I prefer to place it nearly over the bridge-wall a , as shown by Fig. 1. Usually this chamber J is of fire-brick, and its roof is
60 lined with a heavy metallic heating-plate j , and in the roof E, within the limits of the walls of the chamber, are provided a large number of ports or openings J' , through which the hot blast of air is designed to pass into
65 the working chamber A.

It will be seen that I have provided an improved heating arrangement in which the

waste gases from the working chamber are utilized to economically heat to a high degree the air from a cold-blast pipe, the hot
70 blast being delivered into the front part of the working chamber to commingle with the heat and gas passing over the bridge-wall. It is also necessary to feed hot air into the working chamber at intervals along the
75 length of the latter, and to the accomplishment of this end in an economical manner the rear wall of the furnace is built up to provide the blast-heating chambers shown by
80 Figs. 1, 2, and 3 of the drawings. These blast-heating chambers are provided in the rear wall on opposite sides of the stack or uptake, and each chamber is divided by heavy
85 metallic plates or fire-brick partitions k k' into the central circulating-chamber K and the air-blast chambers L L'. The circulating-chambers K are free or unobstructed by
pipes, flues, checker-work, or other heating medium, and they are connected by intake-passages K' with the working chamber A and
90 by outlet-passages K^2 with the uptake, whereby a part of the waste heat and gases from the working chamber are caused to pass through the passages K' into the chamber K to circulate therein and heat up the said
95 chambers and to thence escape through the passages K^2 into the uptake.

The cold blast is delivered by the valved pipe M into the lower or blast chamber L, and from thence is conducted to the upper
100 hot-air chamber L' through the metallic heating pipes or flues N. The pipes are not situated in the circulating-chambers K and exposed to the direct action of the highly-heated gases from the working chamber; but
105 in order to protect the large number of metallic pipes or flues which are required to properly conduct the blast from chamber L to chamber L', I embed the metallic pipes in the walls of the chambers.
110

When the rear wall of the furnace is in the course of erection, I build the brickwork around the metallic pipes or flues to form a protective casing for the same against the direct
115 action of the highly-heated gases. The ends of the pipes or flues N are elbow-shaped or bent to open into the blast-chamber L and the hot-air chamber L', and these embedded pipes N are heated to such an extent as to make the air hot as it passes through the
120 pipes from the chamber L to the chamber L'. In the side walls of the furnace, on opposite sides of the working chamber A, are provided the delivery pipes or flues O O, the rear ends of which are connected with or open into the
125 hot-air chambers L'. These pipes or flues O O are provided on their inner sides with a number of perforations or passages o , which extend inwardly through the furnace-walls and open into the working chamber A, so as
130 to discharge hot air therein at suitable intervals along both sides of the furnace.

No claim is herein made to the structure of a furnace in which the preliminary metal

heating-chambers are made elements in the structure of the stack-wall, substantially as represented by Figs. 5 and 6 of the drawings, as the same forms the subject-matter of a separate application filed by me on the 9th day of March, 1898, Serial No. 673,215.

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

1. In a metallurgical furnace, the combination with a working chamber having a bridge-wall, and a stack or uptake, of isolated heating-chambers situated on the roof of said working chamber, one heating-chamber lying adjacent to the uptake and the other arranged substantially over the bridge-wall, each heating-chamber containing within its walls a heating medium and said heating-chambers communicating with the working chamber by series of ports in the roof thereof, and a blast-pipe connected to said heating-chambers, as and for the purposes described.

2. In a metallurgical furnace, the combination with a stack or uptake, and a working chamber having a bridge-wall, of heating-chambers each divided by a transverse heating medium into upper and lower compartments and said lower compartments communicating directly with the working chamber through series of ports in the roof thereof, said heating-chambers being arranged one near the stack and the other substantially over the bridge-wall in the working chamber, and a blast-pipe connected to the heating-chambers to communicate with the upper compartments thereof only, substantially as and for the purposes described.

3. In a metallurgical furnace, the combination with a stack or uptake, and a working chamber having a bridge-wall at one end, of the heating-chambers situated on the roof of said working chamber, one adjacent to the stack and the other substantially over the bridge-wall, and each communicating with the working chamber through ports in the roof thereof, perforated metallic plates arranged within said heating-chambers and forming the heating mediums therein, and blast-pipes connected to said heating-chambers, as and for the purposes described.

4. A furnace having its rear stack-wall provided with a circulating-compartment which is free from, or unobstructed by, pipes or checker-work and also provided with a blast-chamber and with a hot-air chamber, combined with air-heating pipes embedded in the stack-wall adjacent to said chambers and connected at their ends with the blast-chamber and hot-air chamber, a working chamber connected by a port to said circulating-compartment, an uptake communicating with said circulating-compartment, and off-bearing pipes or flues connected to the upper hot-air compartment, as and for the purposes described.

5. The combination, in a furnace, of the

roof arched adjacent to the stack or uptake and provided in said arched portion with transverse gas-ports, the uptake or stack, the heating-chamber over the arched part of the roof and divided by a transverse partition into two chambers, one of which compartments is connected with the working chamber and the uptake and the other compartment forming an isolated blast-compartment, a blast pipe or pipes connected to the blast-compartment of said heating-chamber, and a port or neck between the uptake and the lower compartment of the heating-chamber, substantially as described.

6. The combination with a stack or uptake, and a working chamber, of the heating-chamber divided into upper and lower compartments, the ports in the roof of the working chamber and connecting said working chamber directly to the lower compartment of the heating-chamber, a port or neck which connects said lower compartment of the heating-chamber with the stack or uptake, and blast-pipes connected to the upper compartment of the heating-chamber, substantially as described.

7. The combination with a working chamber, and an uptake of a metallurgical furnace, of the horizontally-divided heating-chamber F, ports which connect one compartment F' of the heating-chamber with the working chamber, a port or neck connecting the stack and the compartment F' of the heating-chamber, blast-pipes connected to the isolated compartment F² of the heating-chamber, another non-divided heating-chamber J connected to the working chamber, and the blast-pipes between the two chambers F, J, substantially as described.

8. The combination with a working chamber and an uptake, of a heating-chamber situated on the roof of the working chamber and provided with a partition which divides said chamber into two compartments, the lower of which compartments communicates directly by ports with the working chamber and the stack, to insure circulation through said chamber of the waste heat and gases on the way from the working chamber to the stack, another chamber situated at one side of the first-named chamber and over the working chamber, communicating directly therewith by ports in the roof of the same, and a blast-pipe connecting the upper compartment of the first-named chamber with said last-named chamber, substantially as described.

9. The combination with an uptake, and a working chamber, of the roof having the arch E' adjacent to said uptake and provided with ports e which extend directly through the arched portion of said roof, the heating-chamber F having an intermediate partition which divides the heating-chamber into upper and lower compartments, the said lower compartment being in a plane substantially horizontally between the working chamber and the

stack and communicating with said chamber and stack directly by the ports e and the neck, respectively, another chamber situated at one side of the chamber F and on the roof of the
5 working chamber communicating directly with the latter through ports in said roof, a hot-blast pipe connected to the upper compartment of the chamber F and with the other heating-chamber, and a cold-blast pipe connected to said first-named heating-chamber, 10 substantially as described.

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

WILLIAM STUBBLEBINE.

Witnesses:

FRANK WENZEL,
GEO. L. BAUM.