

(No Model.)

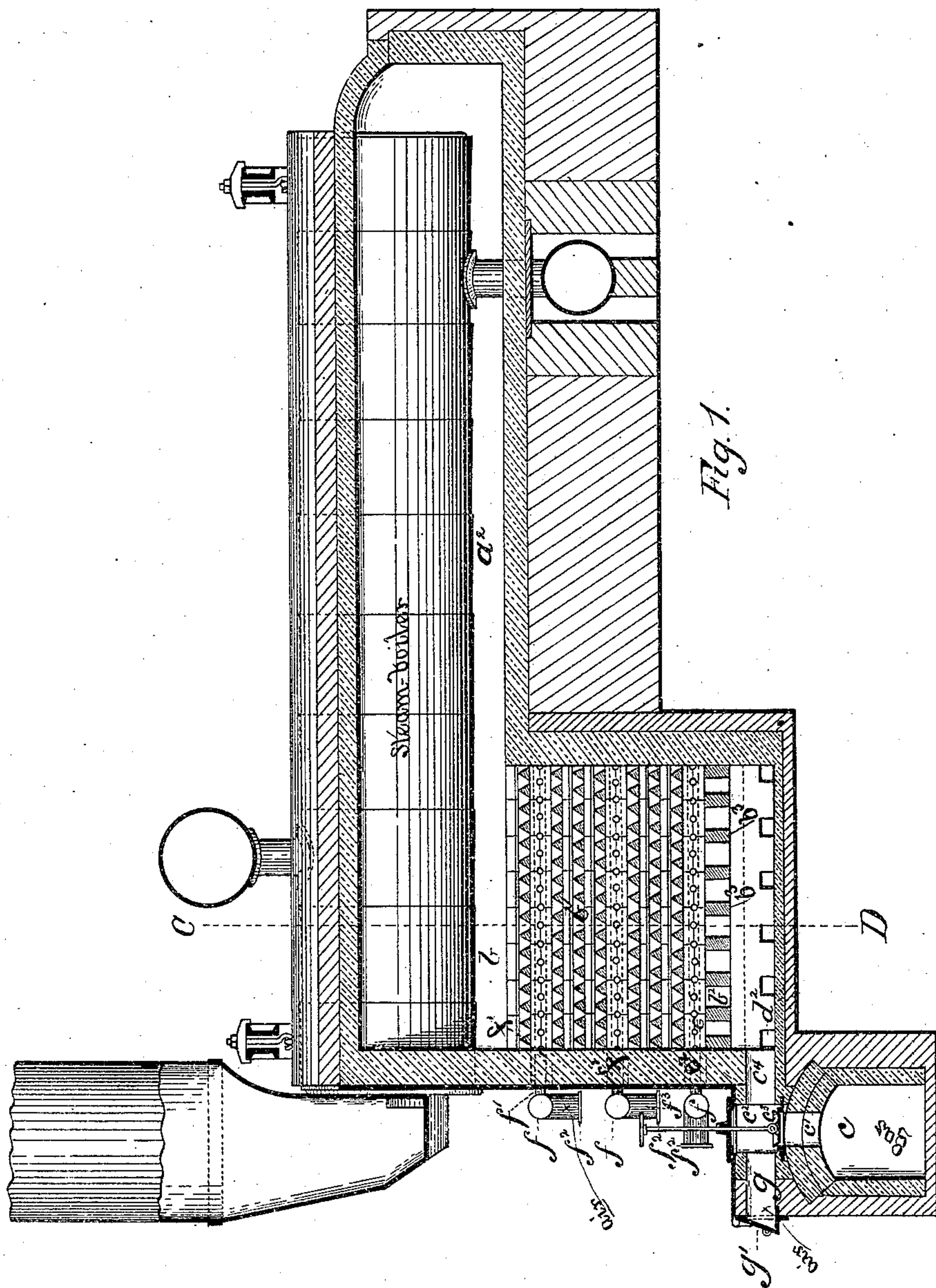
4 Sheets—Sheet 1.

W. SWINDELL.

GAS FURNACE.

No. 310,745.

Patented Jan. 13, 1885.



Witnesses

W. B. Corwin
J. A. Burns

Inventor

William Swindell
by his attys
Bakewell & Kerr

(No Model.)

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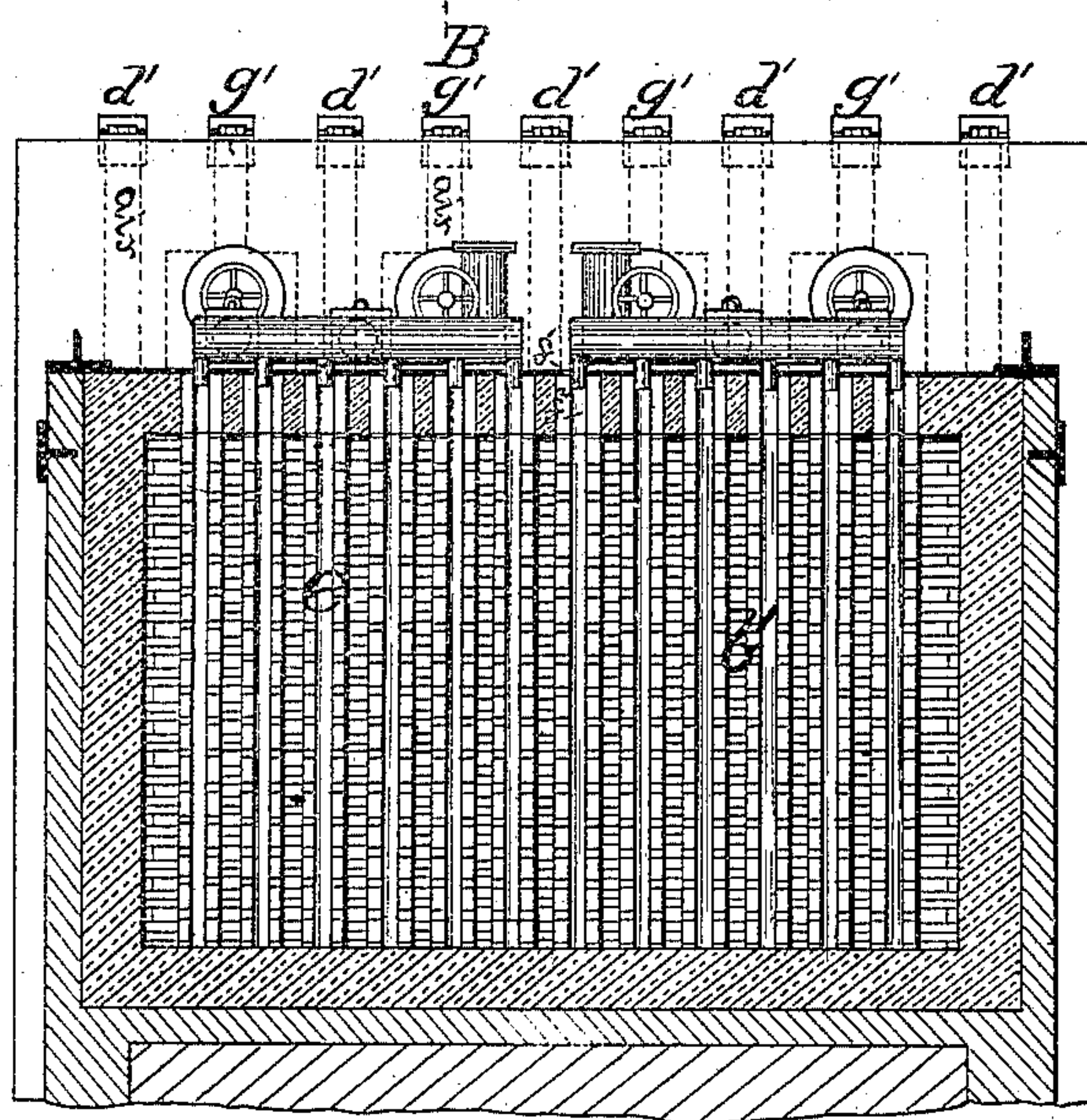
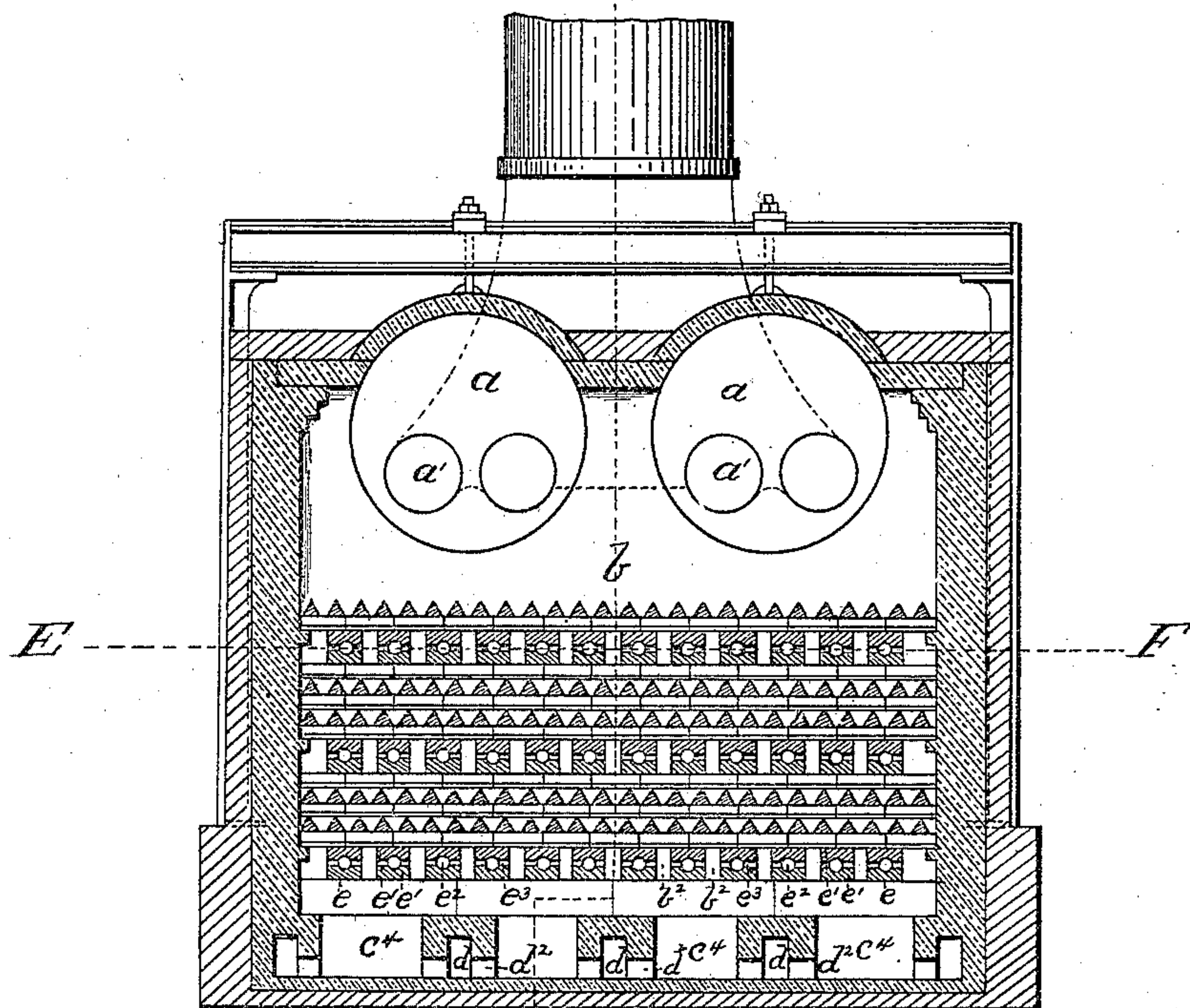
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Fig. 2.
A

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W. B. Conner
J. A. Burns.

Fig. 3.

Inventory

William Swindell
by his attys
Bakewell & Kers

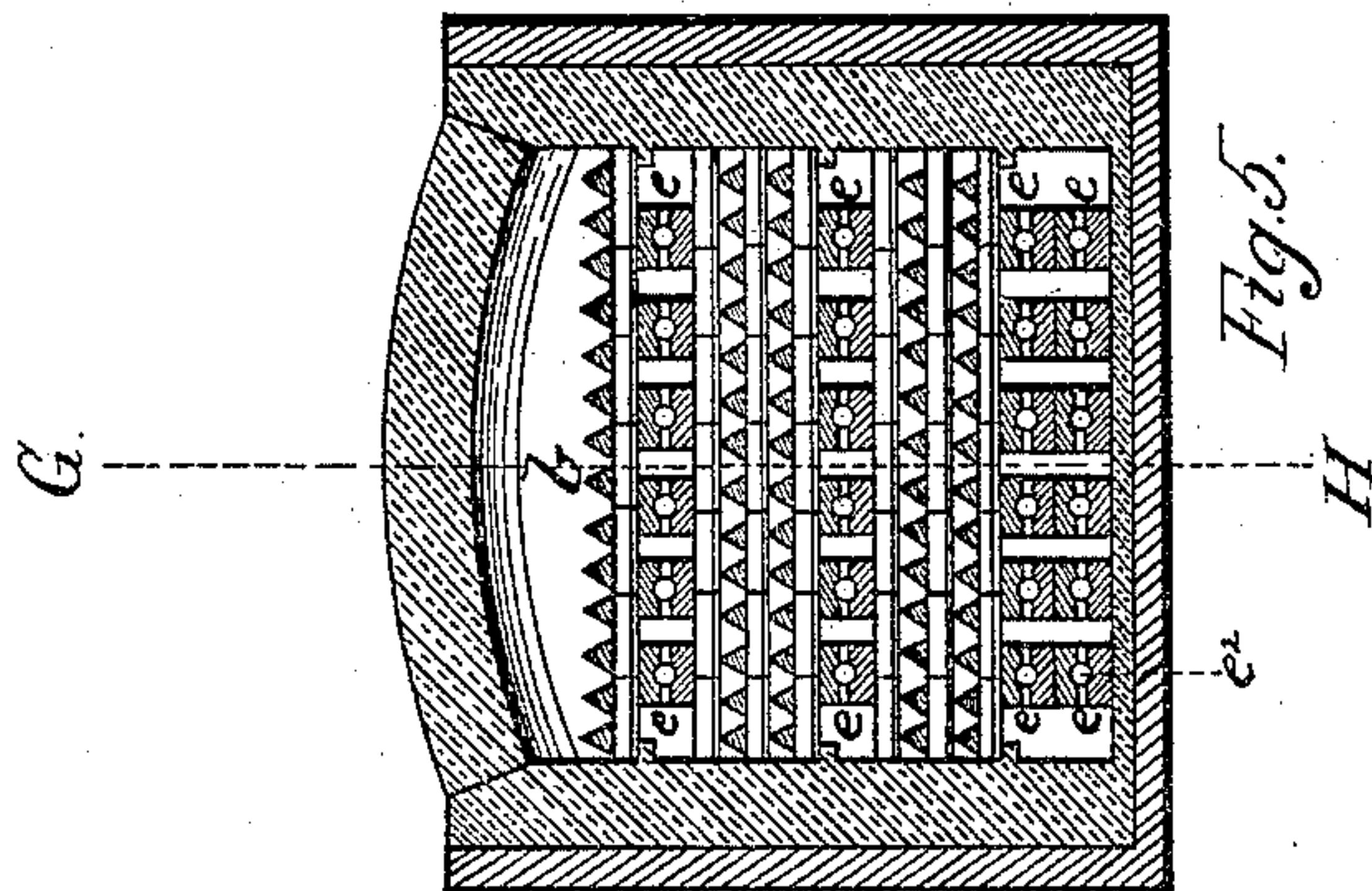
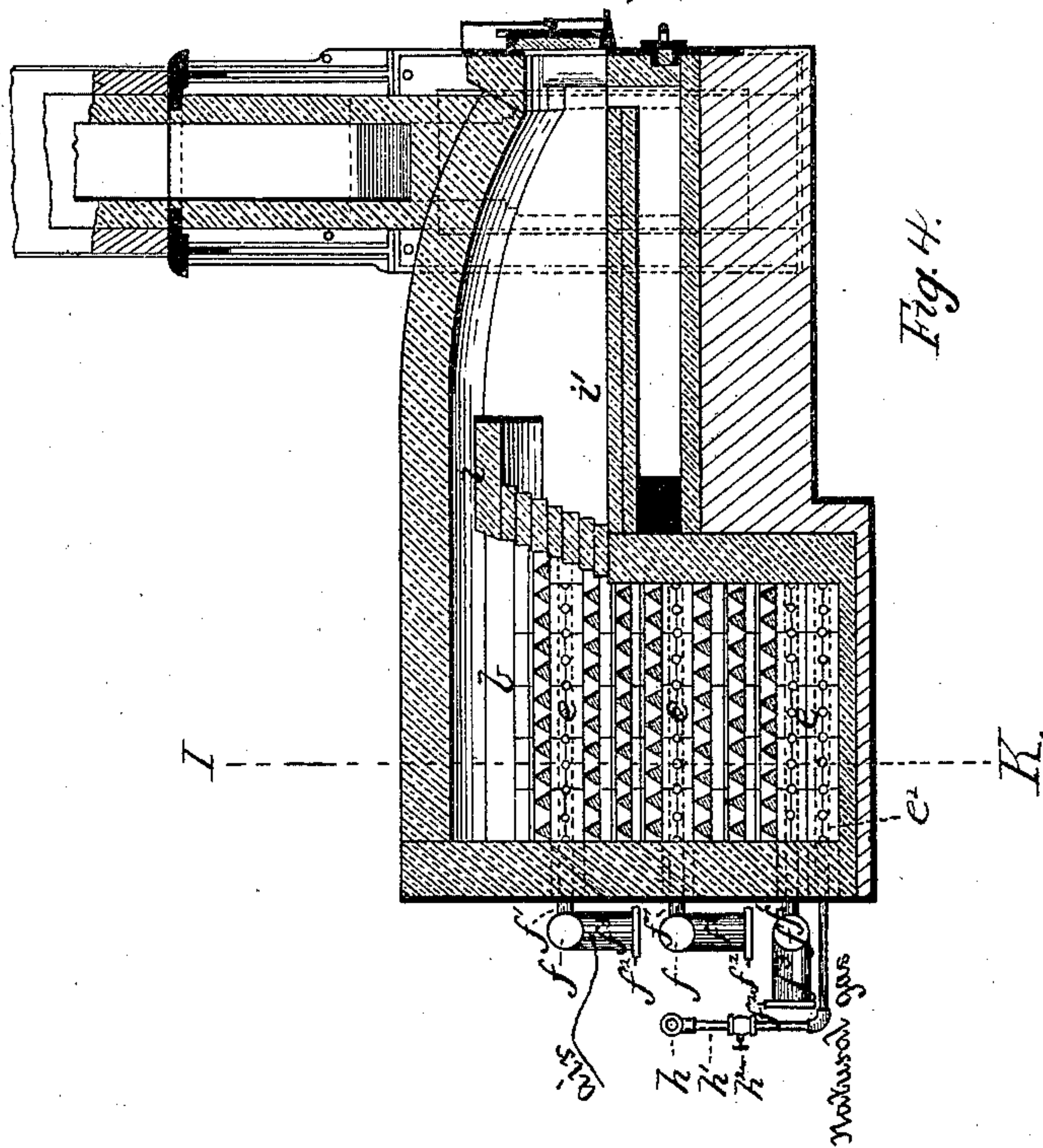
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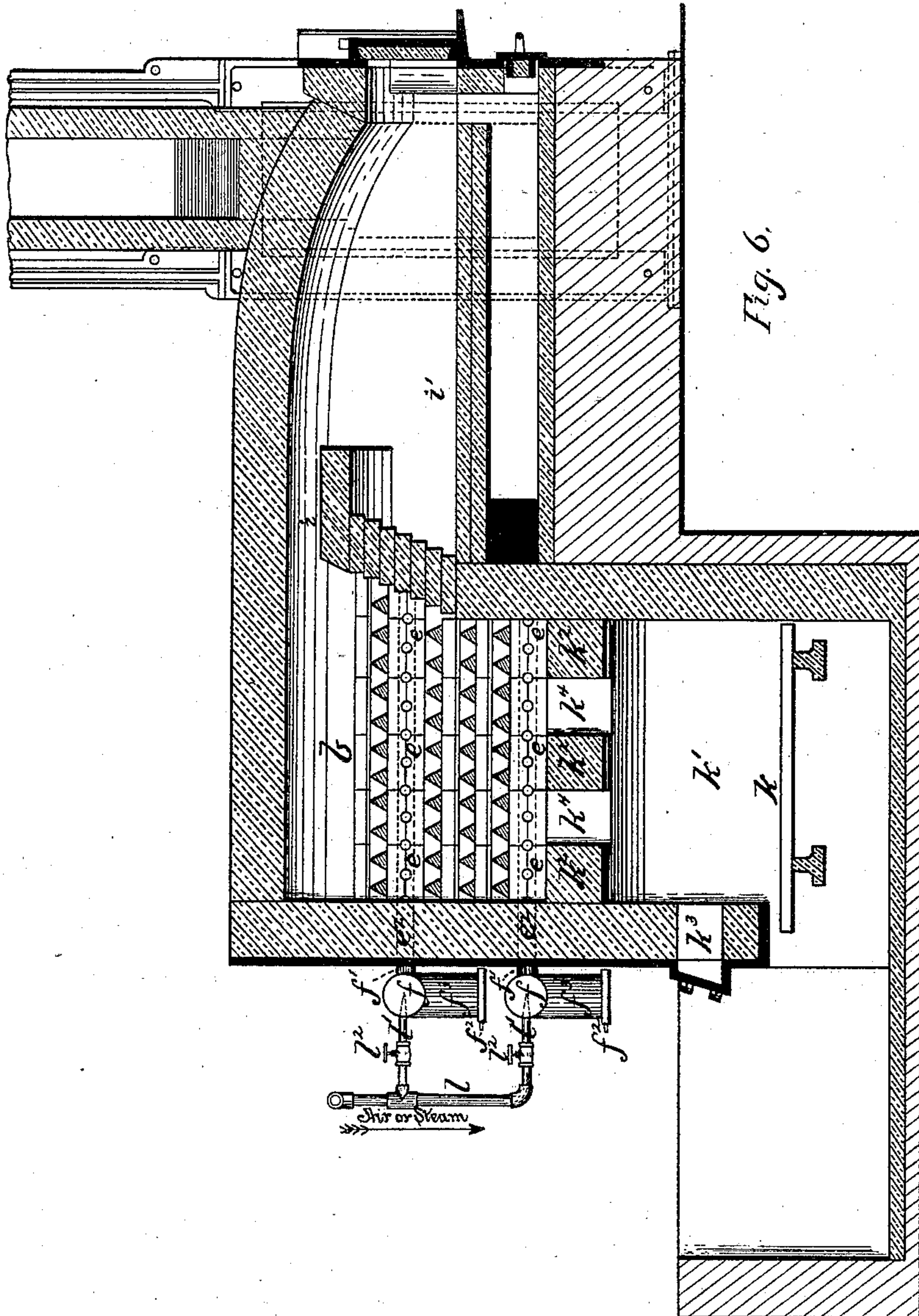
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UNITED STATES PATENT OFFICE.

WILLIAM SWINDELL, OF ALLEGHENY CITY, PENNSYLVANIA.

GAS-FURNACE.

SPECIFICATION forming part of Letters Patent No. 310,745, dated January 13, 1885.

Application filed July 2, 1884. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM SWINDELL, of Allegheny City, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Gas-Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention.

In the construction of gas-furnaces for metallurgic and other purposes the best results are obtained with the form known as "reversible regenerator-furnaces," in which the waste products of combustion and the air and gas are caused to pass alternately through separate regenerators or chambers filled with loosely-piled bricks known as "checker-work." The waste products pass out through one of these chambers, heating the checker-work up to a high temperature, and the air and gas pass in through separate compartments in the other chamber. At intervals the furnace is reversed, and the waste products are caused to pass out through the colder chamber and the air and gas in through the other. For many reasons it is desirable to dispense with this construction and substitute therefor a non-reversing furnace. It is desirable to reduce the number or to do away entirely with the regenerators, because they are enormously expensive and require renewal and repairs. The reversing-valves are expensive and often get out of order. A large amount of gas, which is in the regenerator at the moment of reversal, is driven out into the stack-flue and lost. These and other elements of cost do not exist in a non-reversing furnace in which the waste products, air, and gas pass continually in one direction to their respective destinations.

My invention is designed to obviate the necessity of these things by the construction of a furnace in which the waste products of combustion are utilized to heat the air and gas, and each of the currents has a continuous course in one direction.

To enable others skilled in the art to make and use my invention, I will now describe it by reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of a steam-boiler furnace embodying my invention on the line A. B of Fig. 2. Fig. 2 is a

transverse vertical section of the same on the line C D of Fig. 1. Fig. 3 is a horizontal section on the line E F of Fig. 2. Fig. 4 is a vertical longitudinal section of a reheating and annealing furnace, arranged for use with natural gas, on the line G H of Fig. 5. Fig. 5 is a transverse vertical section on the line I K of Fig. 4. Fig. 6 is a vertical longitudinal section of a reverberatory furnace, showing an ordinary fire-grate under the checker-work chamber.

Like letters of reference indicate like parts in each.

Referring, now, to the construction shown in Figs. 1, 2, and 3, which show my invention as applied to a steam-boiler furnace, *a* indicates the boilers, each provided with flues *a'*, built into the brick-work in the usual manner. Under the front end of the boilers, in the place usually occupied by the fire-chamber, is a chamber, *b*, which is filled with checker-work composed of longitudinal and transverse layers of checker-brick *b'*, made of fire-clay. Arranged at any convenient place below the level of the chamber *b* is the main gas-sewer *c*, which leads from the gas-producers arranged at any convenient point. In the crown of the sewer *c* are passages *c'*, which lead up into valve-boxes *c''*, in which are suitable valves, *c'''*, controlling the entrance of the gas into the furnace. Leading from the valve-boxes *c''* are flues *c'''*, which extend into the lower end of the chamber *b*. Air is admitted into the flues *c'''* by flues *d*, the outer ends of which are controlled by valves *d'*, and passes from the flues *d* through the lateral ports *d''* into the flues *c'''*. The checker-work in the chamber *b* is made of any desired depth, and is supported by tiles *b''*. Included in the checker-work are horizontal rows of brick-flues *e*, constructed of sections, each section being formed of two half-bricks, *e'*, Fig. 2, the flue-opening *e''* being formed by cutting it out equally in the meeting faces of both. In like manner these bricks are provided with lateral channels, *e'''*, which extend from the central passage, *e''*, to the sides. When built up in the checker-work, there is a vertical passage, *b''*, between each line of flue-bricks, as shown in Fig. 2. In the construction illustrated I have shown three horizontal layers of the flue-bricks *e*, arranged with a portion of the

checker-work b' between them. Communicating with the flues e by short pipes f' entering flues e^2 , which extend through the front wall, are air-pipes f , which are controlled by valves f^2 , so that air can be admitted at any desired level or levels, and discharged into the checker-work. The purpose of this construction is to obtain a gradually-increasing heat in the checker-work, and more perfect combustion of the gas as it rises through the interstices of the same. An initial combustion takes place in the chamber c^4 , and the gas which is not consumed in this combustion, rising through the checker-work, meets the successive injections of air from the flues e until it is perfectly consumed. The incidental effect of this combustion below and in the checker-work is to raise the temperature of the latter to such a degree that it aids in the combustion of the gas, and heats the air which is supplied through the flues e^2 to a very high temperature. Another effect of the presence of the checker-work is that it acts as a reservoir of heat, and thereby maintains a very uniform temperature under the boilers, and prevents much of the damage done to the boilers and their flues, which is due to the sudden changes of temperature caused by unequal firing. The heat after leaving the chamber b passes back through the space a^2 under the boilers and enters the flues a' at the rear end in the usual manner. Connected with valve-boxes c^2 are flues g , controlled by valves g' , which are for the purpose of admitting air to burn out any soot which may collect in the lower flues, and around the valves c^3 . The flues d may be used for like purposes in connection with the lower flues c^4 . If it is desired to admit gas through the flues e , it can be done by connecting the pipes f' directly to the gas-sewer c . In this way I can have every alternate flue admit gas and the others admit air. I obtain by this construction a gradually-increasing temperature as the gas rises in the chamber b , and as the upper portion of the checker-work is much hotter than the lower portion the air admitted through the upper flues, e , will be of a higher temperature and in a better condition to combine with and effect the combustion of any unconsumed gas which may rise to that point. The checker-work is always kept at a high temperature as a consequence of the combustion of the gas in the chamber b , so that I can utilize the ordinary fire-chamber of a boiler-furnace without greatly additional cost, to accomplish the same purpose that has heretofore been effected properly only by the use of the expensive reversing regenerators heretofore mentioned.

In Figs. 4 and 5, which illustrate my improvement applied to a reheating or annealing furnace, I show a construction for using natural gas instead of manufactured gas. Here the bottom flues c^4 are dispensed with, and the space is filled up with one or two horizontal courses of bricks e , through the flues e^2 of the lower of which the gas is intro-

duced from the main h by means of branch pipes h' , which are controlled by valves h^2 , Fig. 4. The gas first meets the air from the next above course of bricks e and the initial combustion takes place. Complete combustion is effected by the successive supplies of hot air from the upper courses of flue-bricks e , as in the former case. I prefer to admit the gas by means of the lowest course of flues e^2 because it burns best when not heated, and the lower part is the coldest part of the chamber b . It may, however, be admitted through one of the higher courses. In this case i indicates the bridge and i' the bed of the furnace.

In Fig. 6 I show the application of my invention to an ordinary reverberatory furnace. I construct the chamber b above the fire-grate k , and support the checker-work on the roof k^2 of the fire-chamber k' . The chamber k' has the usual door, k^3 , and the flame and gas rise into the chamber b through openings k^4 in the roof k^2 . The courses of flue-bricks e are arranged as may be desired in the checker-work.

If desired, I can apply to any of the described constructions an artificial blast of air or steam to the flues e^2 . In Fig. 6 I show a steam-pipe, l , and jet-pipes l' , controlled by valves l^2 , for injecting in jets of steam to aid in the combustion of the gases, and to force the air into the furnace at an increased velocity. I can supply the blast by means of a fan or blower, if desired, and thus obtain the required volume of air.

I have illustrated and described my improvement with horizontal air flues or conduits entering at different levels; but while I prefer this construction, I do not limit myself thereto, as I can have them enter on the same level, and I can arrange the flues vertically, if desired; or I can place them at any desired angle to the bottom and admit the air or gas or both at the lower ends, so that the same shall rise in the chamber and be distributed therein throughout the entire length of the flues.

Instead of introducing the air or gas at one end only of each conduit, as shown in the drawings, I can, if desired, introduce them at both ends, or I can introduce them into each alternate series of conduits by the opposite ends, thus equalizing the supply of air and gas throughout the chamber. I can also introduce gas at one end of these conduits and air at the other end, thereby permitting the mixture and ignition of the gas and air within the conduits themselves. I provide the pipes f with a downwardly-extending inlet-pipe, f^3 , at the lower end of which the valve f^2 is placed, so that the air shall be drawn up into the flues e^2 with greater velocity than if admitted directly from the outside.

Each of the constructions described can be applied to reverberatory, boiler, glass-melting, and other furnaces.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A boiler or other furnace having a chamber arranged in front of the bridge-wall, filled with open checker-work in which is arranged one or more courses of flue-bricks, for dis-
5 charging air or air and gas into the checker-work, substantially as and for the purposes described.

2. The combination, in a furnace, of a chamber filled with checker-work, having one or
10 more courses of flue-bricks arranged in the checker-work, with means for admitting air and gas into the checker-work, substantially as and for the purposes described.

3. The combination of a pile of checker-
15 work arranged in the fire-chamber of a furnace, with a course or courses of flue-bricks arranged in the checker-work, and provided

with lateral channels for delivering air, steam, or gas into the checker-work, substantially as and for the purposes described. 2C

4. A furnace having a chamber filled with checker-work, with a course or courses of flue-bricks arranged in the same, in combination with means for supplying air or gas to said
25 flues, and a blast apparatus for forcing air, steam, or gas into the flues, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 19th day of June, A. D. 1884.

WILLIAM SWINDELL.

Witnesses:

W. B. CORWIN,
JNO. K. SMITH.