

No. 841,664.

F. BREDEL.

PATENTED JAN. 22, 1907.

RECUPERATIVE FURNACE.

APPLICATION FILED DEC. 29, 1905.

3 SHEETS—SHEET 1.

Fig. 2.

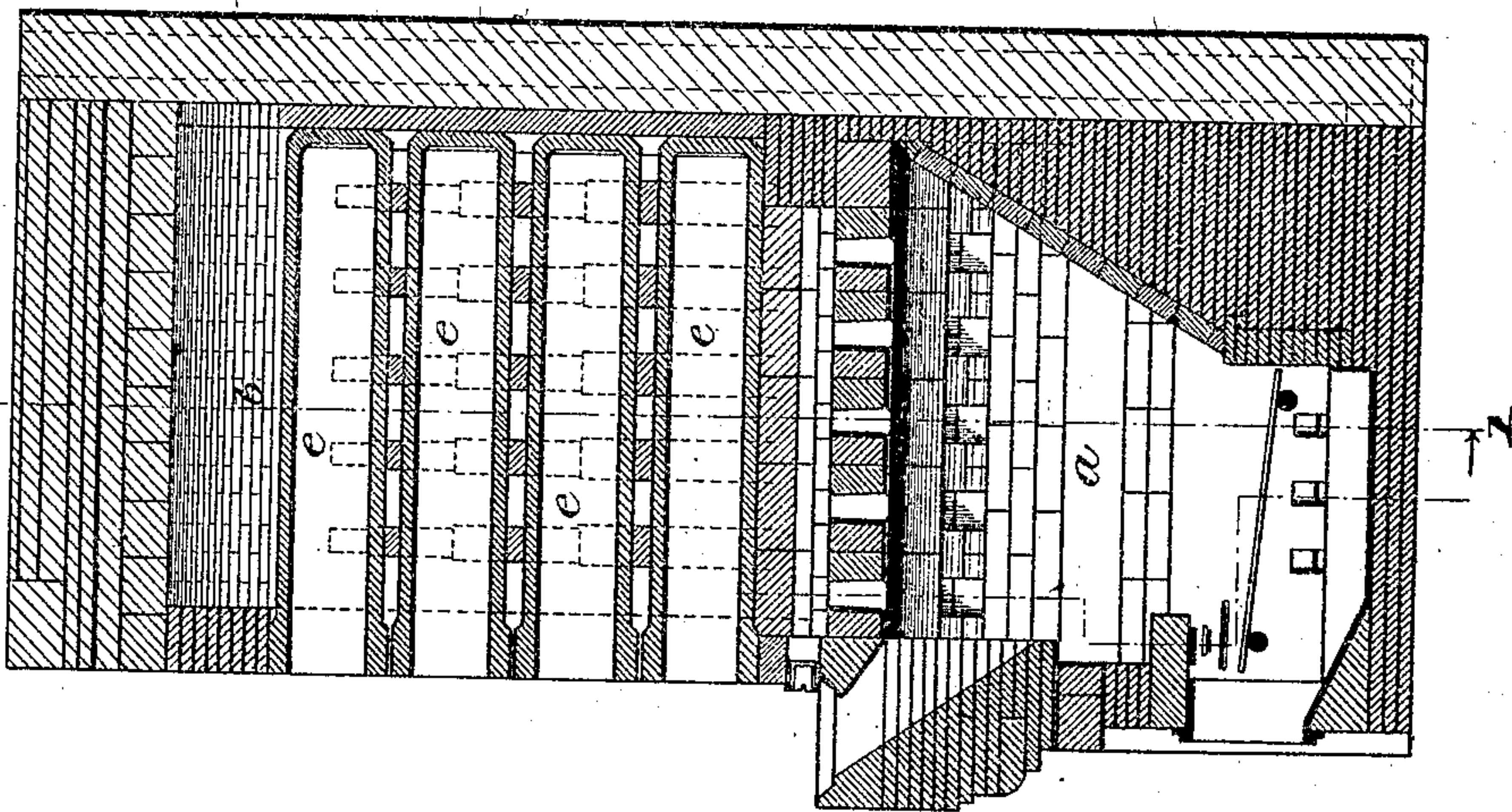
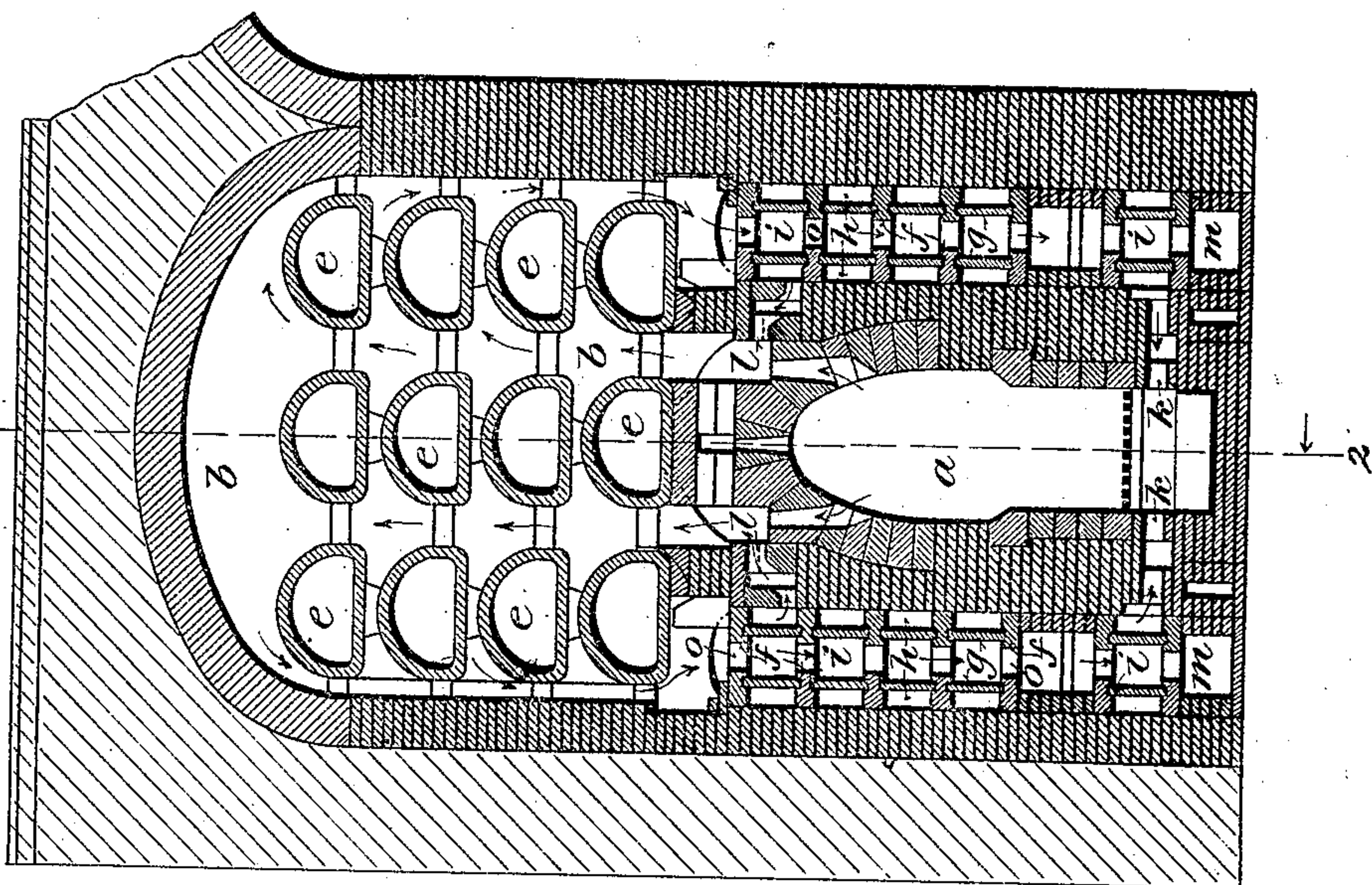


Fig. 1.



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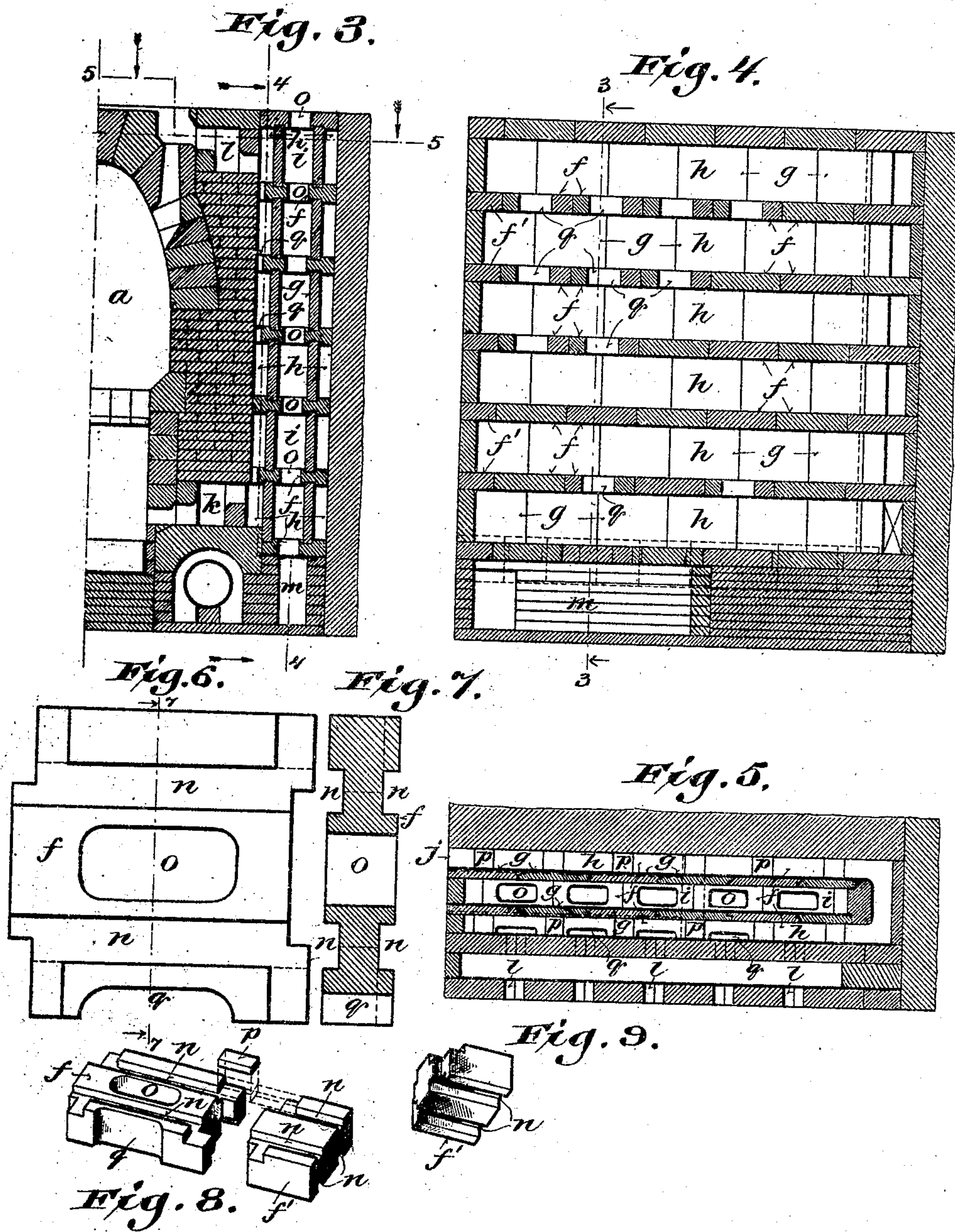


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3 SHEETS--SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 11.

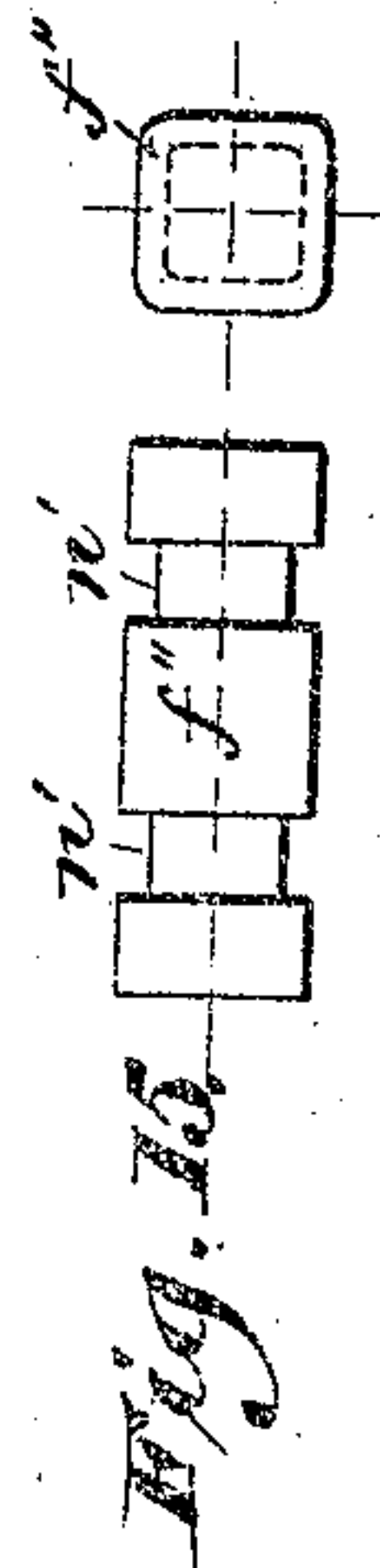
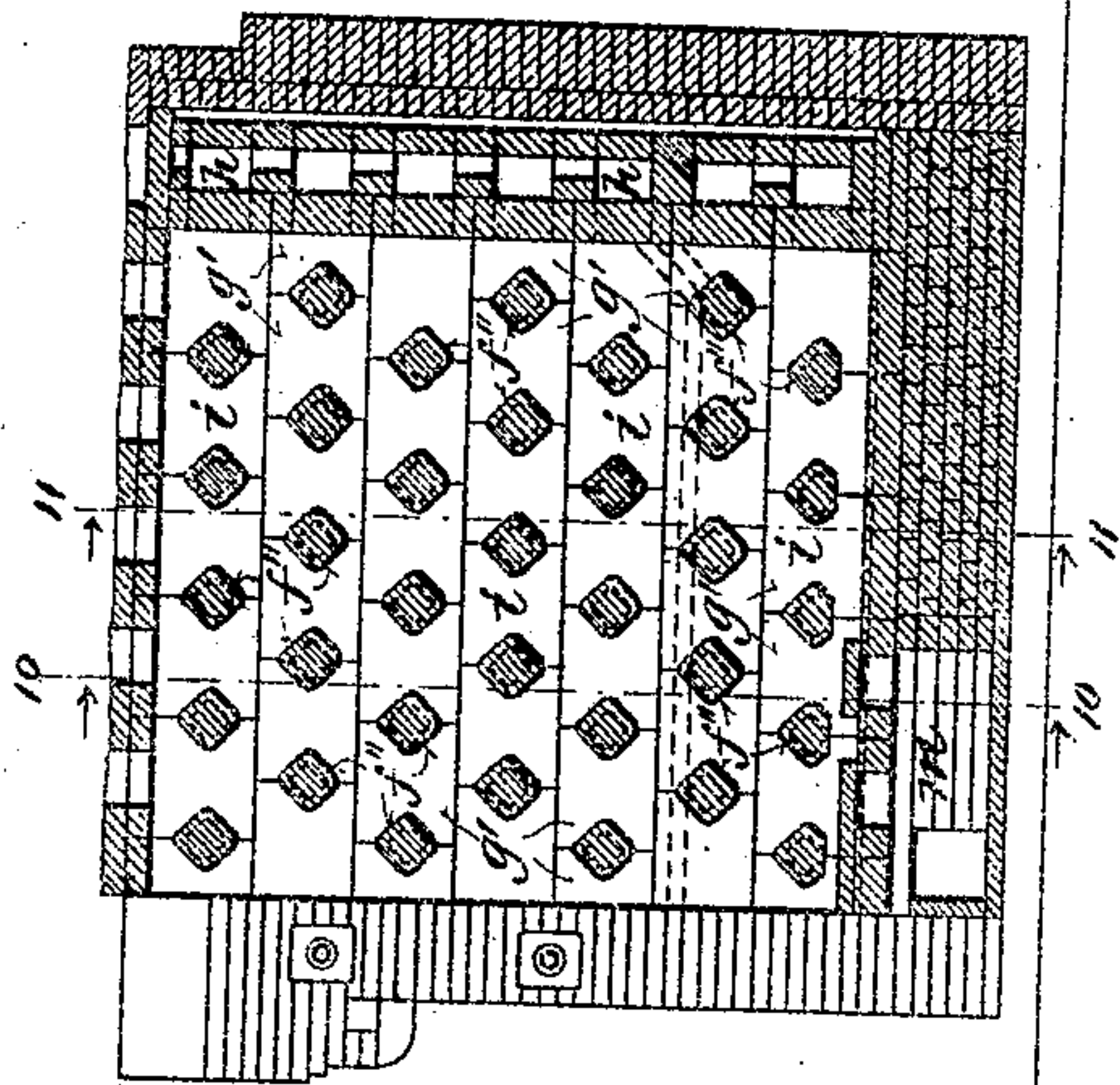
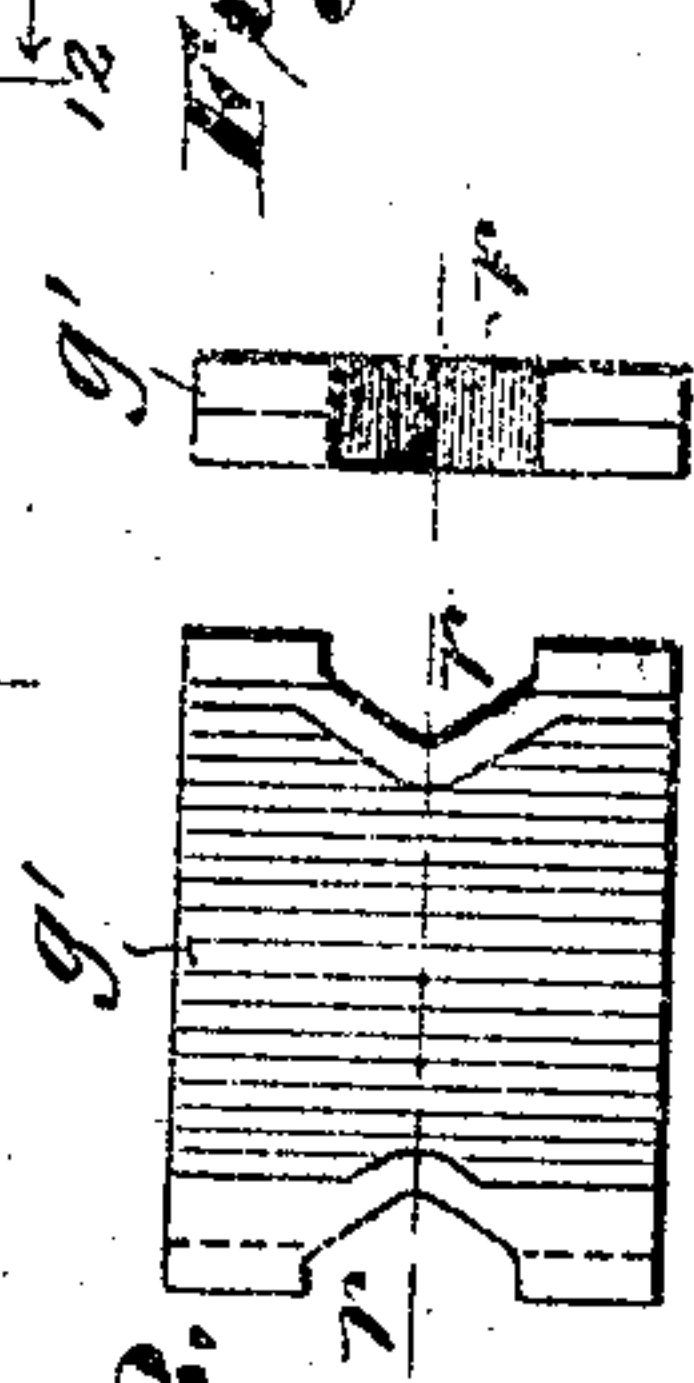
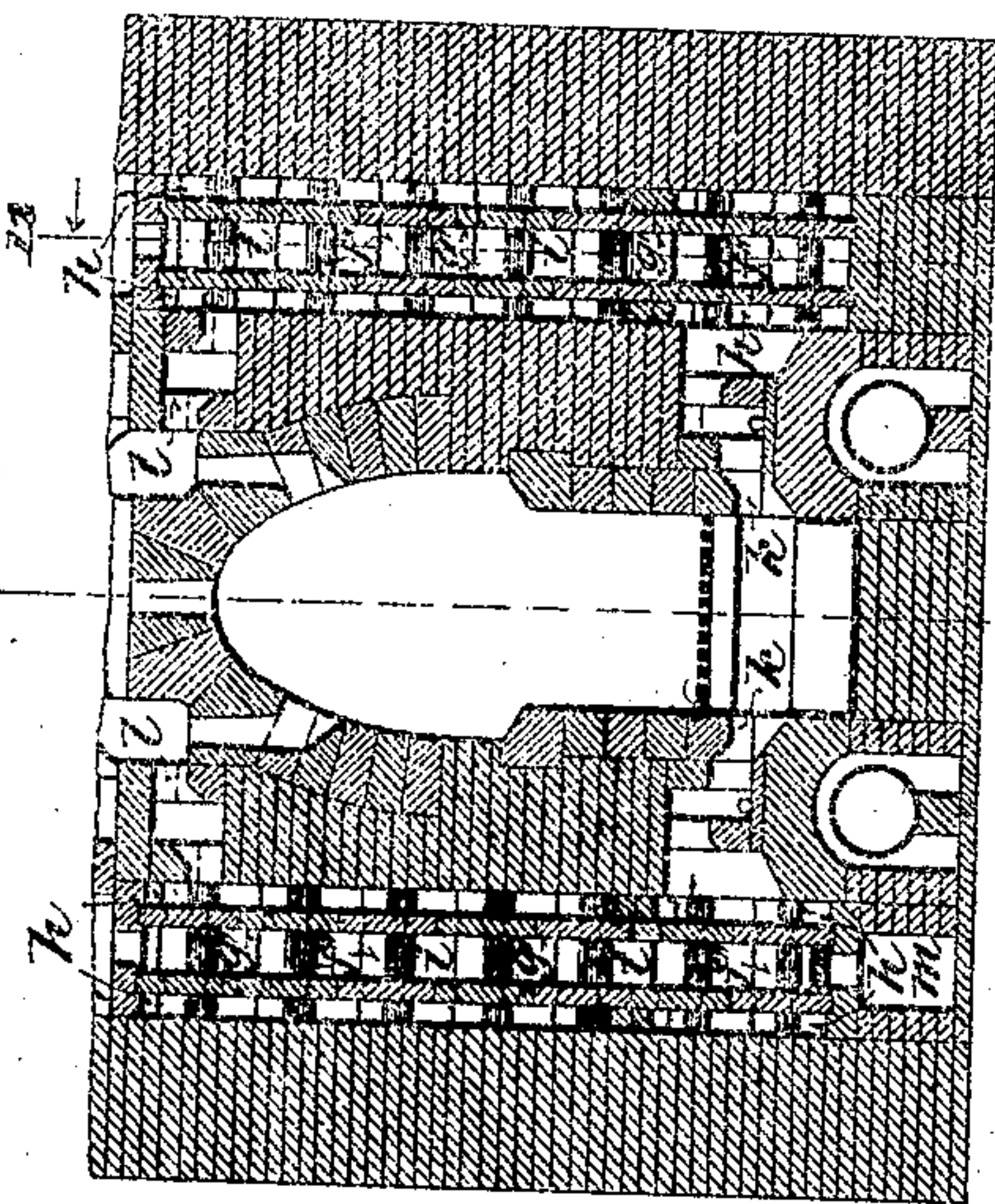


Fig. 16.



Fig. 10.



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# UNITED STATES PATENT OFFICE.

FREDERICK BREDEL, OF MILWAUKEE, WISCONSIN.

## RECUPERATIVE FURNACE.

No. 841,664.

Specification of Letters Patent.

Patented Jan. 22, 1907.

Application filed December 29, 1905. Serial No. 293,736.

*To all whom it may concern:*

Be it known that I, FREDERICK BREDEL, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Recuperative Furnaces, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

10 This invention relates to furnaces for heating retorts, muffles, &c., and more particularly to the construction of the recuperators for heating the air-supply to such furnaces by the hot waste gases escaping therefrom.

15 The main objects of the invention are to provide a recuperator with a continuous vertical gas-flue in which soot and ashes will not lodge sufficiently to obstruct the passage of the products of combustion or waste gases  
20 from the furnace, to prevent the loosening and displacement of the component parts of the recuperator by explosions or otherwise, and thus avoid leakage, which would destroy or impair the efficiency of the device, and  
25 generally to simplify and improve the construction and operation of recuperators in this class of furnaces.

It consists in certain novel features of construction and in the peculiar arrangement  
30 and combinations of parts, as hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like letters  
35 designate the same parts in the several figures.

Figure 1 is a vertical cross-section on the line 1 1, Fig. 2, of a furnace embodying the invention in one form. Fig. 2 is a vertical longitudinal section of the same on the line  
40 2 2, Fig. 1. Fig. 3 is an enlarged vertical cross-section on the line 3 3, Fig. 4, of one of the recuperators. Fig. 4 is a vertical longitudinal section of a recuperator on the line 4 4, Fig. 3. Fig. 5 is a horizontal section on the line 5 5, Fig. 3. Fig. 6 is a plan view of a  
45 separator-block. Fig. 7 is a vertical cross-section on the line 7 7, Fig. 6. Fig. 8 is a perspective view of a whole and a fractional separator-block, showing their interlocking  
50 end formations and an intermediate bridge-block for covering the joint between them in one of the air-flues. Fig. 9 is a perspective view showing the under side of a fractional separator-block. Fig. 10 is a vertical cross-

section, the left-hand half being on the line 55 10 10 and the right-hand half on the line 11 11, Fig. 11, showing recuperators of a modified construction. Fig. 11 is a vertical longitudinal section on the line 12 12, Fig. 10. Fig. 12 is an enlarged inside view of a division or partition block used in this form of  
60 recuperator. Fig. 13 is a plan or top edge view, and Fig. 14 is an end view, of the same. Fig. 15 is an enlarged side view of one of the separator-blocks used in connection with  
65 division-blocks like that shown in Figs. 12, 13, and 14; and Fig. 16 is an end view of the same.

Referring to Figs. 1, 2, and 3, *a* designates the fire-box or generator-chamber, *b* the combustion-chamber, and *e e* retorts inclosed in the combustion-chamber. These parts may be constructed and arranged as usual in furnaces of this class. On each side of the fire-box of the furnace, as herein shown and described, is a recuperator embodying the  
75 present invention for preheating the air-supply of the furnace. Each recuperator comprises supporting and spacing blocks *f*, called "separator-blocks," extending horizontally  
80 across the flue space or chamber inclosed by the furnace-walls and continuous series of vertically-disposed solid partition blocks or tiles *g*, dividing said space or chamber into two outer air-flues *h* and an intermediate gas-  
85 flue *i*.

Air is admitted to two or more of the flues *h* on each side of the furnace through openings *j*, which may be located at the front end of the furnace, as shown in Fig. 5, and after  
90 being heated by its passage through said flues is discharged into the fire-box *a* below the grate through openings *k* and into the combustion-chamber through openings *l*, as shown in Fig. 1.

The waste gases or products of combustion enter the gas-flues *i* at the top and escape therefrom at the bottom into ducts *m*, as indicated by arrows on Fig. 1, the ducts *m* leading into a chimney or smoke-stack. (Not  
100 shown.)

The separator-blocks *f* are formed with longitudinal grooves *n*, as shown in Figs. 6, 7, and 8, to receive and hold the upper and lower edges of the partition-blocks *g*, and between said grooves they are formed with  
105 large openings *o*, which afford free communication between the several parts of the flue *i*.



and a direct unobstructed passage for the waste gases or products of combustion from the top to the bottom of each recuperator. At their sides, which are parallel with the grooves *n* and extend beyond the outer faces of the blocks *g*, they bear against opposite walls of the recuperator or flue-chamber, and thereby firmly support said blocks *g* against lateral displacement in either direction. At their ends the separator-blocks are preferably formed, as shown in Fig. 8, with interlocking projections which produce staggered or broken joints between them in the adjoining air and gas flues. To further provide against leakage between the air and gas flues, the end joints between the separator-blocks in the air-flues are covered by bridge pieces or blocks *p*, which are let into recesses in said separator-blocks flush with their upper faces, as shown in Figs. 5 and 8, and the partition-blocks *g* are preferably formed on their adjoining vertical edges, as shown in Fig. 5, with rabbet or tongue-and-groove joints.

At the front and rear ends of the recuperator each tier or row of separator-blocks is filled out by fractional blocks *f'*, which have no openings through them, as shown in Figs. 8 and 9.

Some of the separator-blocks are or may be formed with recesses or indentations *q* to afford communication between adjoining air-flues arranged one above another, as shown in Figs. 3 to 8, inclusive.

The several air-flues *h* may be connected with each other in various ways, and the openings for supplying air thereto and for delivering the heated air into the furnace may be variously arranged, and the number and arrangement of the recuperators as a whole with relation to other parts of the furnace may also be varied according to varying conditions and circumstances.

Referring to Figs. 10 to 16, inclusive, showing recuperators of a modified construction, but still embodying the principle and essential features of the invention, the separator-blocks *f''* are made of quadrangular prismatic shape, as shown in Figs. 15 and 16, and are set in the furnace, as shown in Fig. 11, with their lateral faces inclined. They are formed parallel to their end faces, with grooves *n'* to receive and hold the adjoining end edges of the division-blocks *g'*, which are formed, as shown in Figs. 12 and 14, with correspondingly-shaped indentations *r*. These divisional blocks may be fluted or corrugated on their outer faces next to the air-flues *h* to increase their heat-radiating area. Soot or ashes deposited on separator-blocks of this form will slide off from their inclined upper faces and fall to the bottom of the gas-flues *i*, from which they can be readily removed. They do not, however, like the blocks *f*, divide the spaces outside of the partition-

blocks horizontally into separate and distinct air-flues, as shown in Figs. 1, 3, and 4.

Various modifications in details of construction and arrangement of parts other than those hereinbefore noted may be made without departing from the principle and intended scope of the invention.

I claim—

1. In a recuperative furnace, a recuperator comprising a continuous series of solid partition-tiles dividing the recuperator-chamber into air and gas flues, and separator-blocks grooved to receive the edges of said partition-tiles and to prevent lateral displacement thereof and bearing against and bracing opposite walls of the recuperator-chamber, substantially as described.

2. In a recuperative furnace, a recuperator comprising walls which inclose a chamber, a continuous series of vertically-disposed solid partition-tiles dividing said chamber into air and gas flues, and horizontally-disposed separator-blocks grooved to receive the adjoining edges of said partition-tiles and projecting on one side beyond their outer faces and bearing against and bracing opposite walls of said chamber, substantially as described.

3. In a recuperative furnace, a recuperator comprising walls inclosing a flue chamber or space, a continuous series of solid vertically-disposed partition-tiles dividing said chamber into air and gas flues, and horizontally-disposed separator-blocks grooved to receive the upper and lower edges of said partition-tiles and extending on one side beyond the outer faces thereof and bearing against and bracing opposite walls of said chamber, substantially as described.

4. In a recuperative furnace, a recuperator comprising walls inclosing a flue space or chamber, solid partition-tiles dividing said space into air and gas flues, and separator-blocks extending across said chamber and bearing on opposite sides against the walls of said chamber, said separator-blocks being grooved between and parallel with said walls to receive the upper and lower edges of said partition-tiles and having openings through them in the gas-flue space between the partition-tiles, substantially as described.

5. In a recuperative furnace, a recuperator comprising walls inclosing a flue-chamber, continuous series of solid partition-tiles dividing said chamber into air and gas flues, and separator-blocks having interlocking projections at their adjoining ends and longitudinal grooves in the under and upper sides to receive the upper and lower edges of the partition-tiles beyond which they project and bear against opposite side walls of said chamber, substantially as described.

6. In a recuperative furnace, a recuperator comprising walls inclosing a flue chamber or space, vertically-disposed partition-tiles di-



5 viding said space into air and gas flues, separator-blocks grooved to receive the upper and lower edges of said partition-tiles beyond which they project against opposite walls of said chamber, and bridge-blocks covering joints between adjoining ends of the separator-blocks, substantially as described.

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

FREDERICK BREDEL.

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