No. 742,708. PATENTED OCT. 27, 1903.

K. M. MITCHELL & J. DELL.

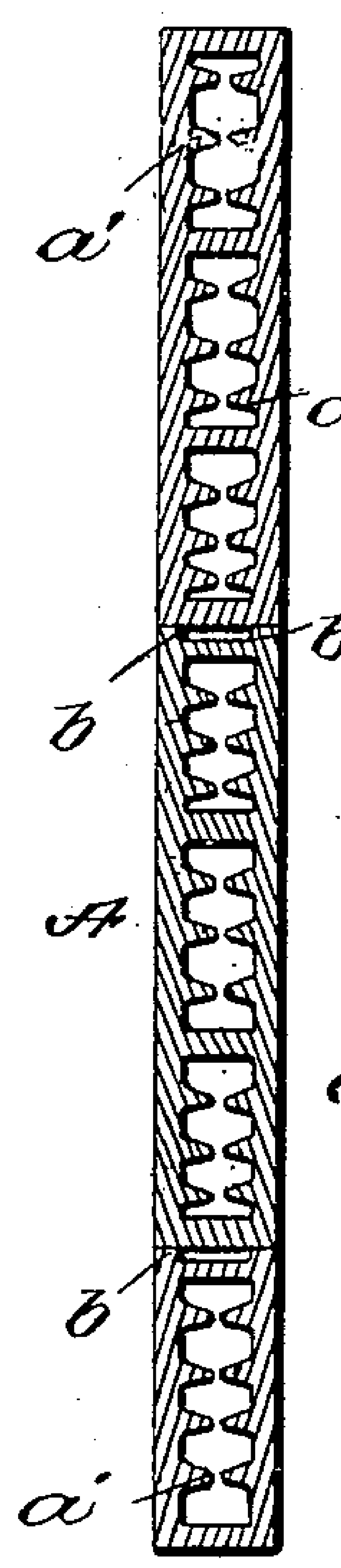
RECUPERATOR GAS FURNACE.

APPLICATION FILED JAN. 6, 1903.

NO MODEL. 5 SHEETS—SHEET 1.

Fig. 3.

Fig. 1



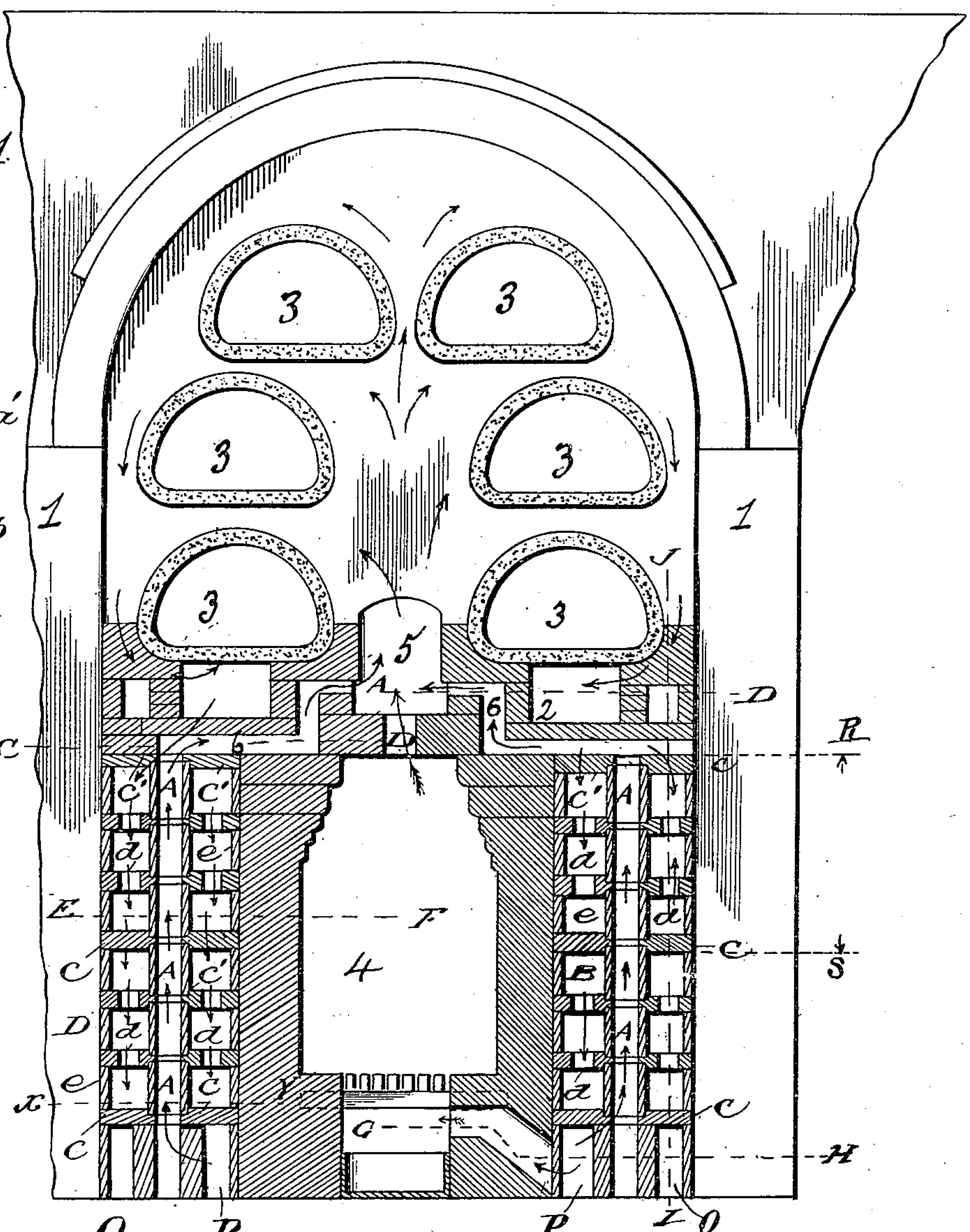


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Fig. 2.

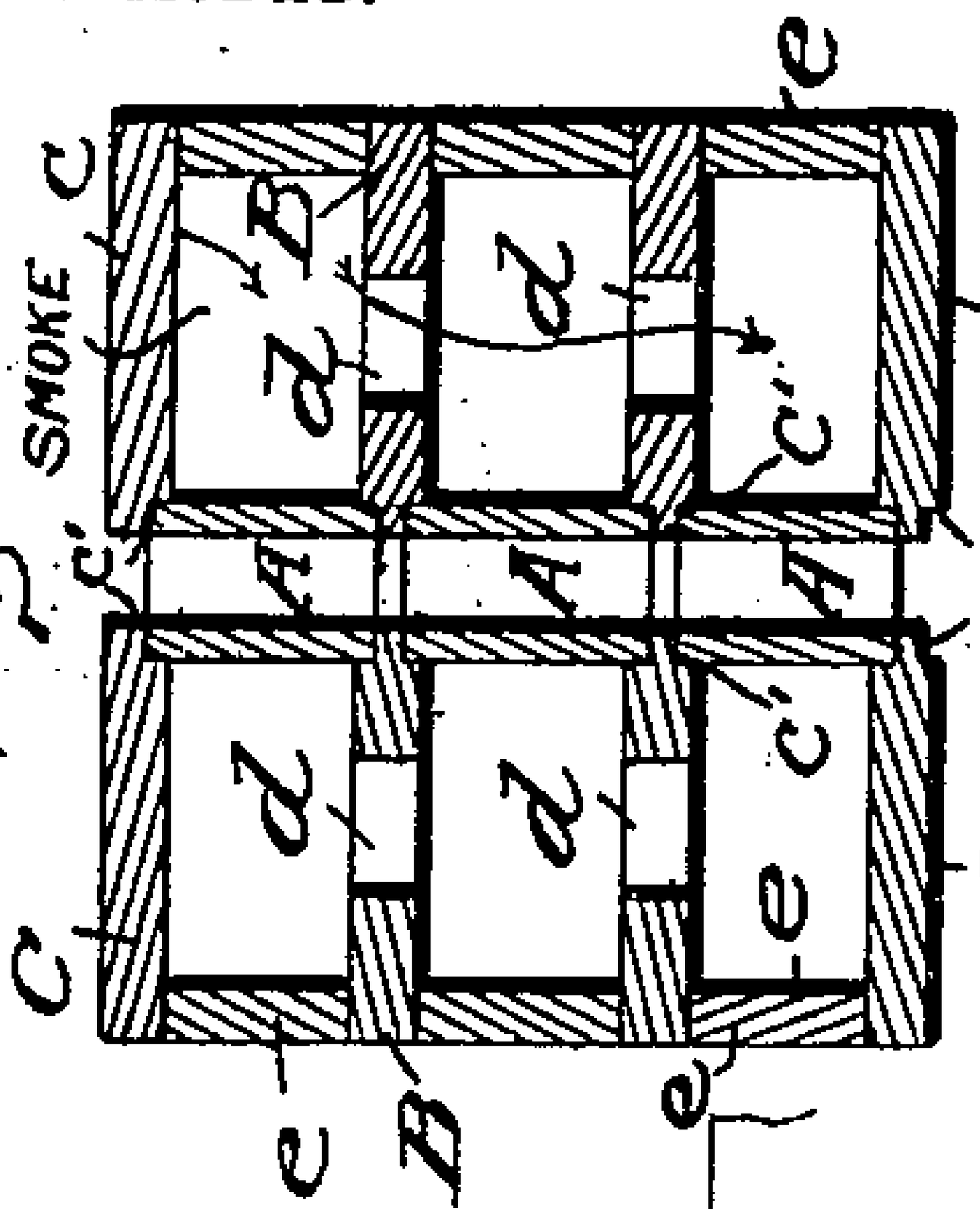


Fig. 7.

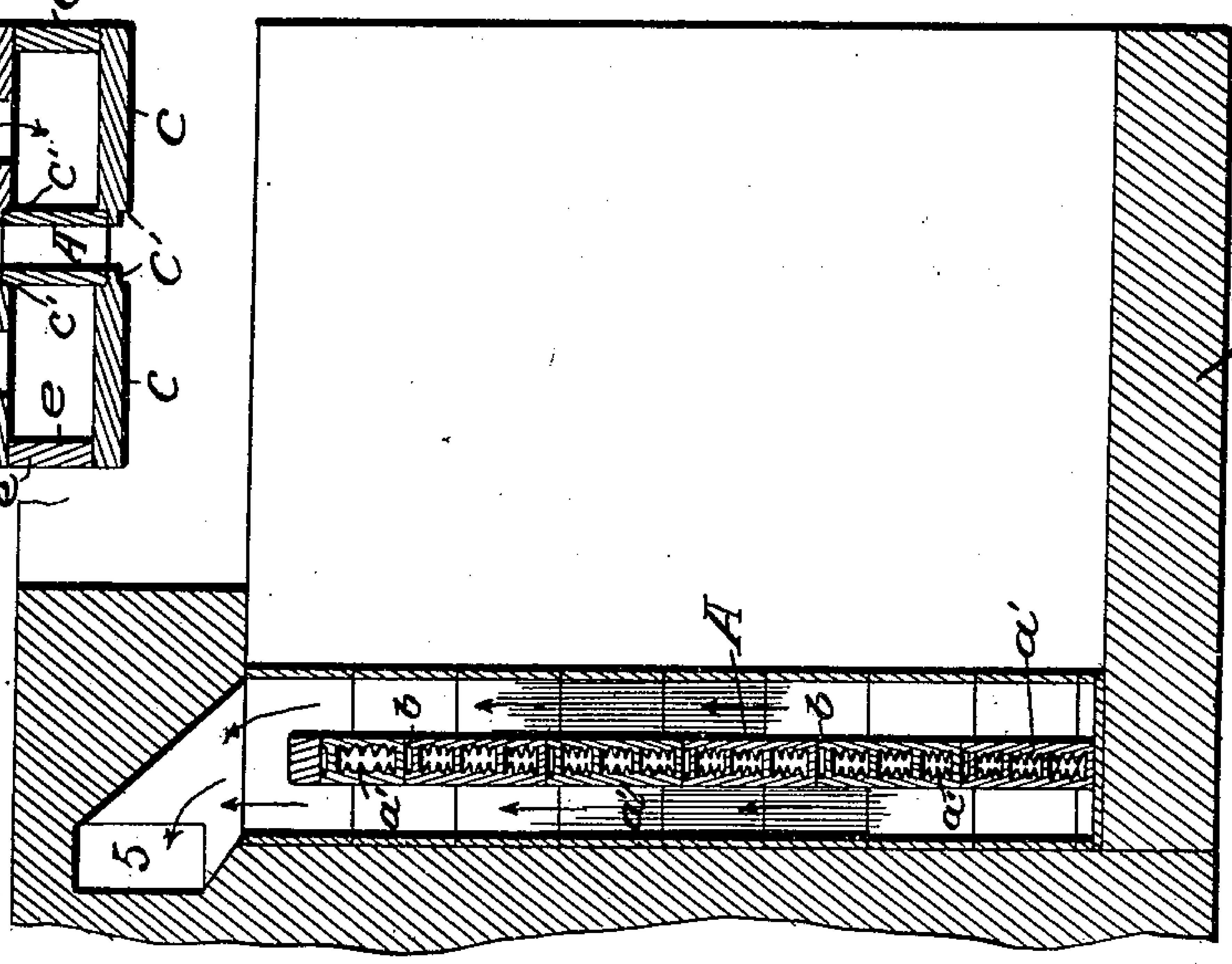
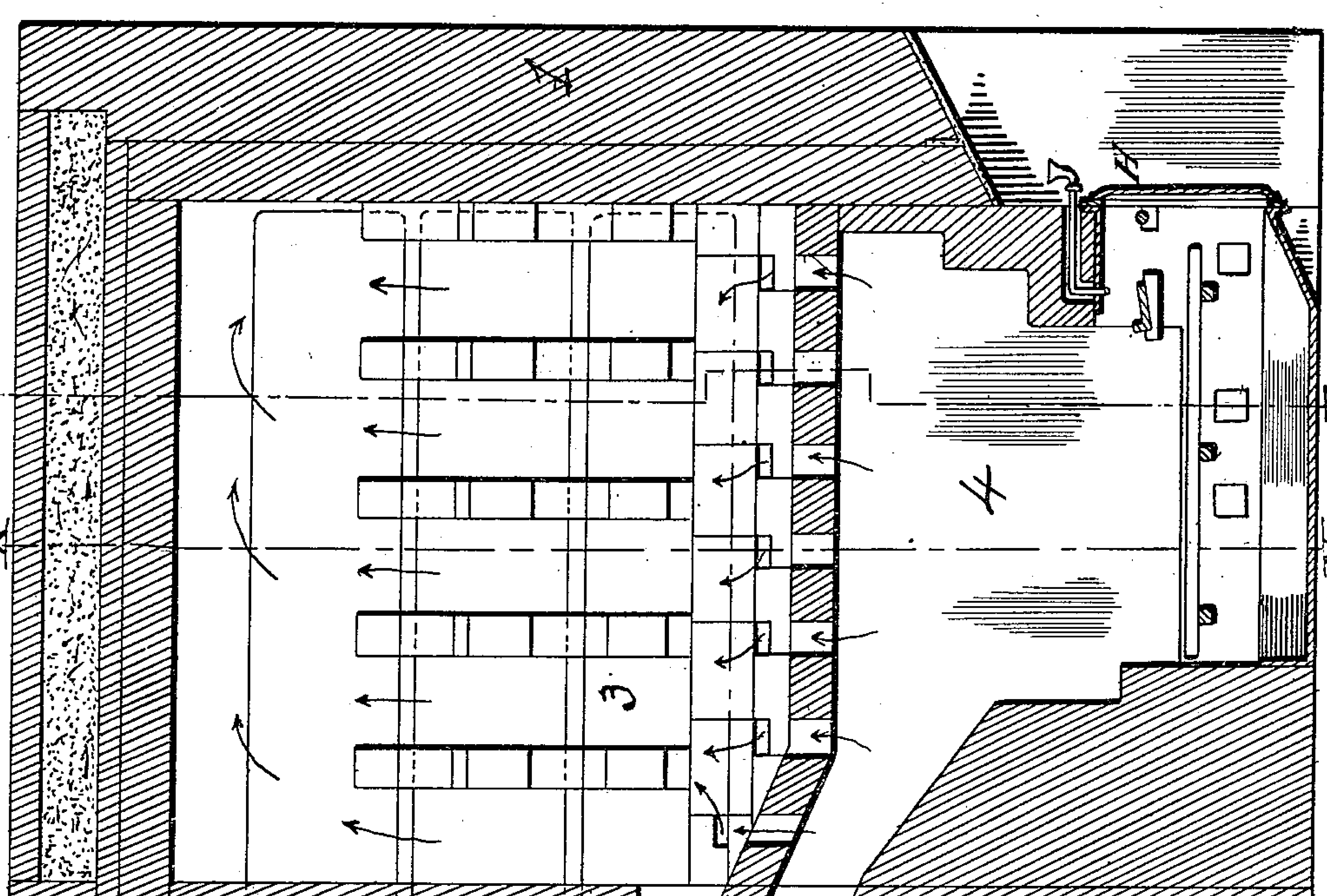


Fig. 4a.



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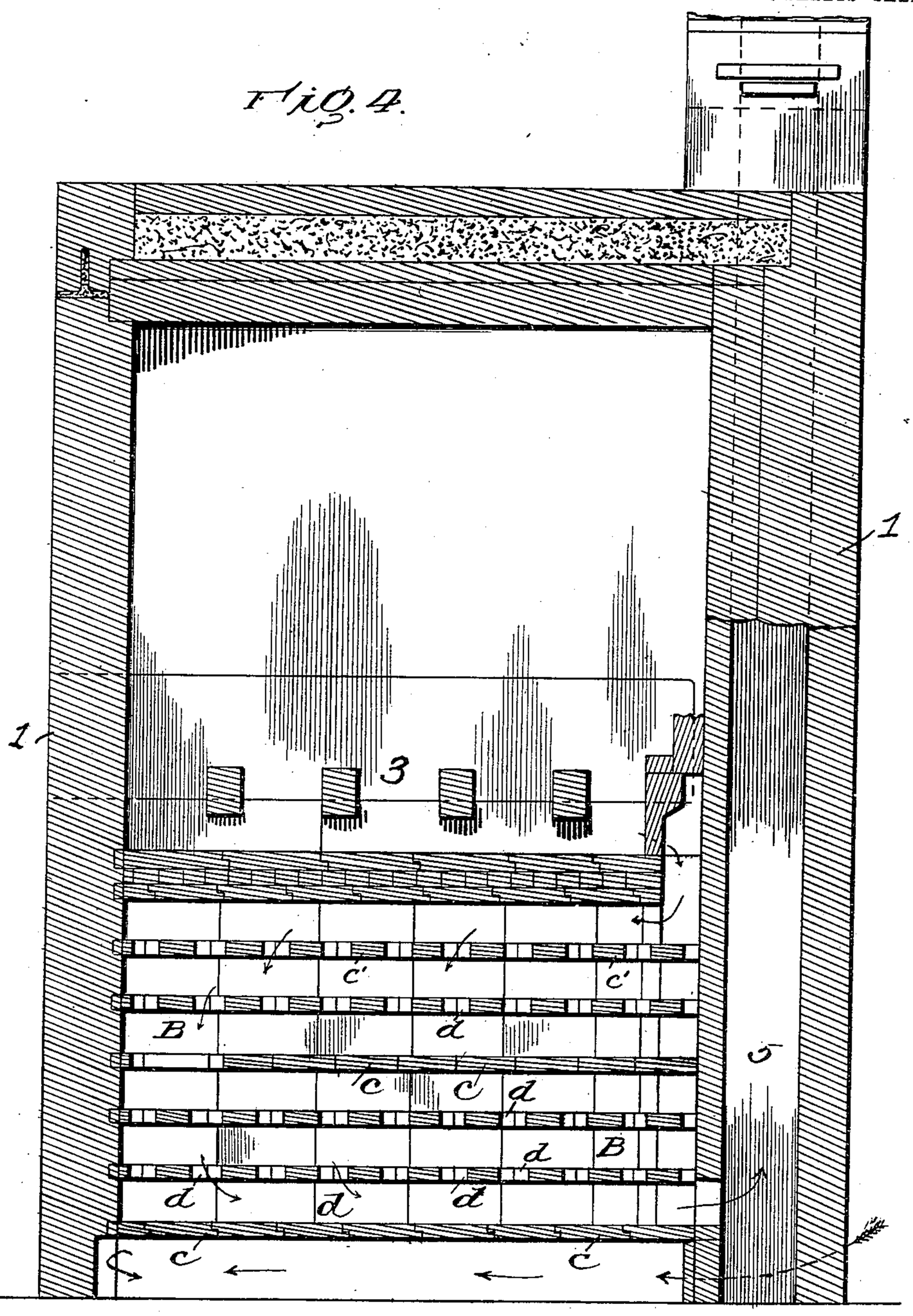
NO MODEL. 5 SHEETS—SHEET 3.

Fig. 4.



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NO MODEL. 5 SHEETS—SHEET 4.

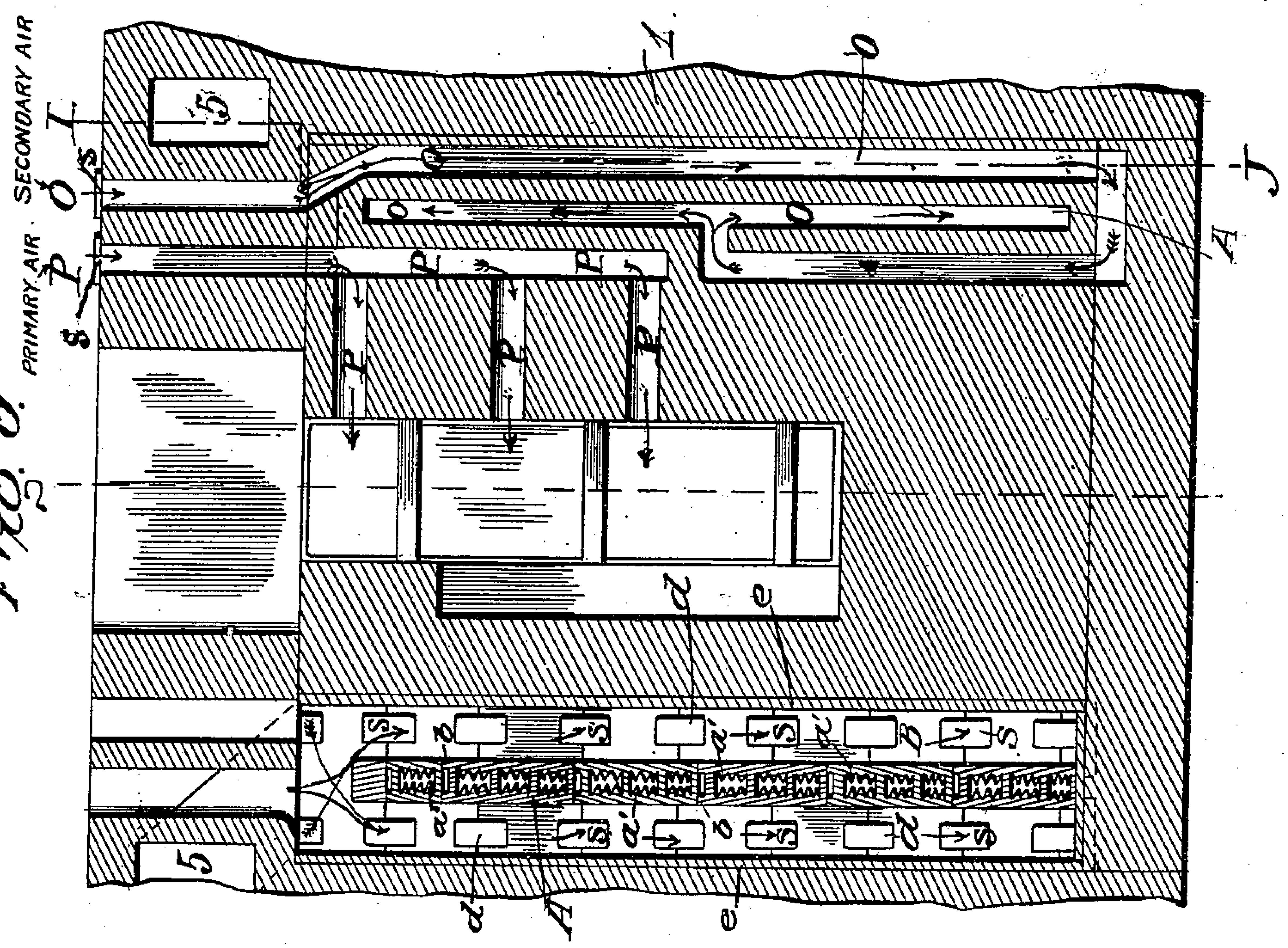

FIG. 6.

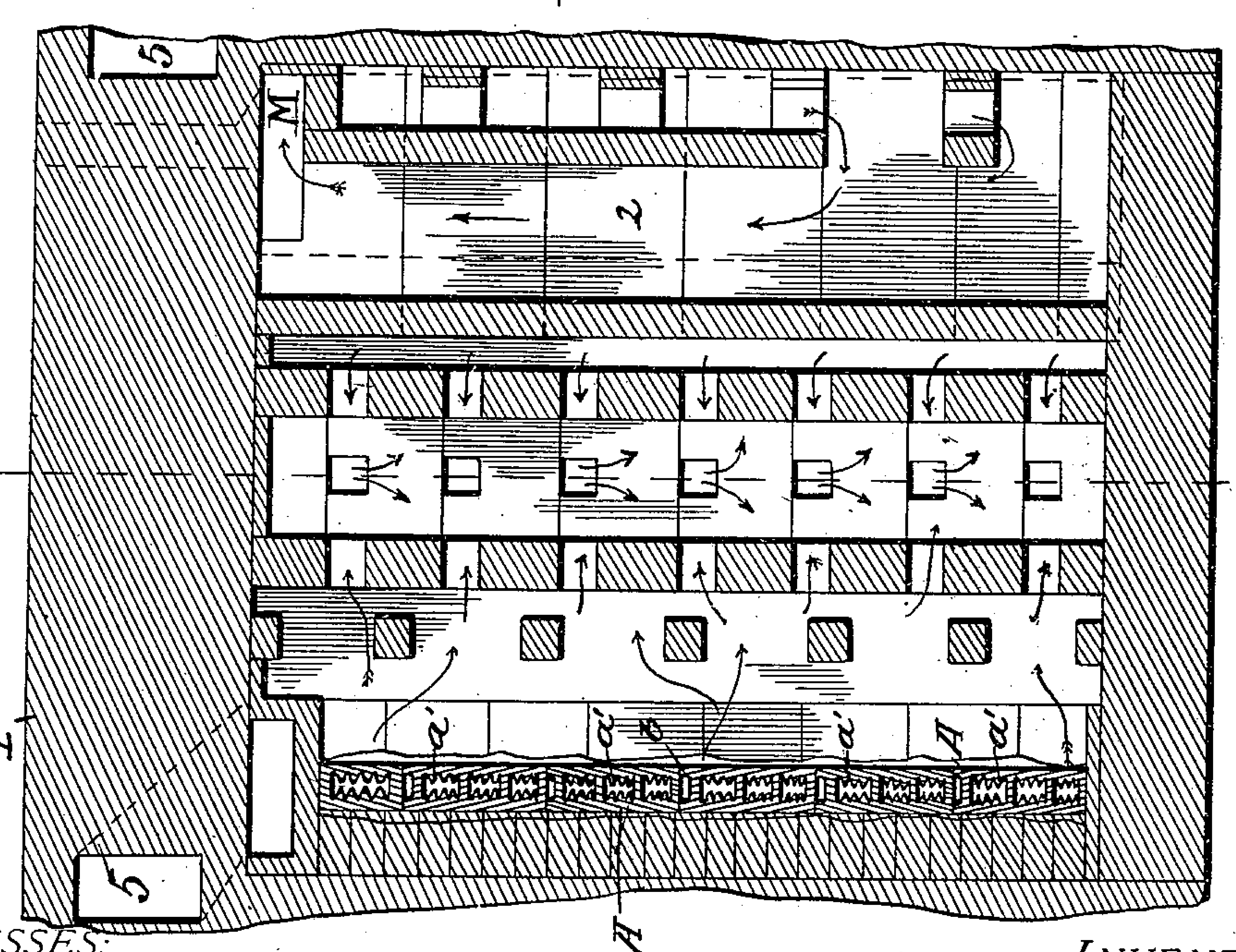

FIG. 5.

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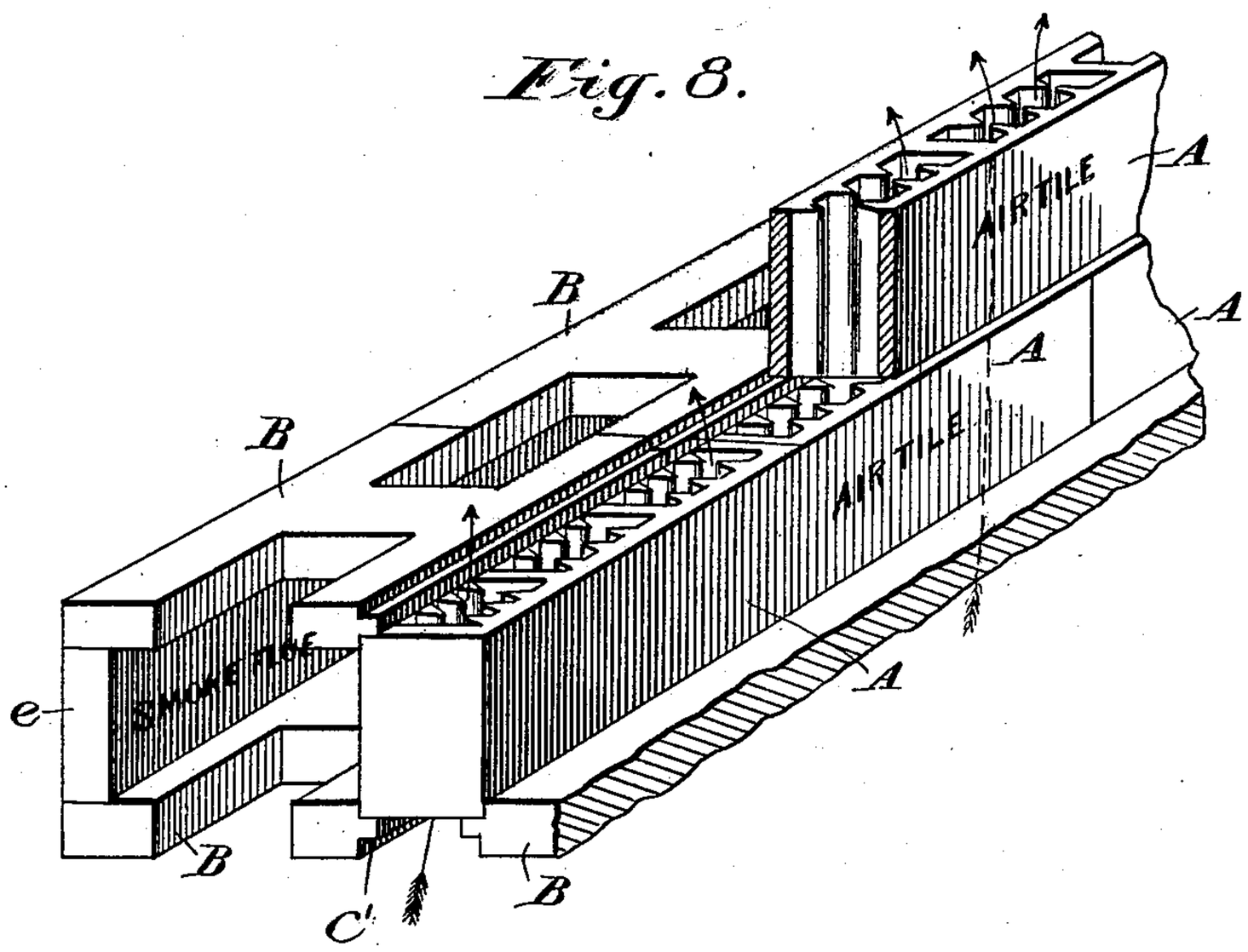
APPLICATION FILED JAN. 6, 1903.

NO MODEL. 5 SHEETS—SHEET 5.

Fig. 8.



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No. 742,708. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

KERR M. MITCHELL, OF ST. JOSEPH, AND JOHN DELL, OF ST. LOUIS, MISSOURI.

RECUPERATOR GAS-FURNACE.

SPECIFICATION forming part of Letters Patent No. 742,708, dated October 27, 1903.

Application filed January 6, 1903. Serial No. 138,004. (No model.)

To all whom it may concern:

Be it known that we, KERR M. MITCHELL, residing at St. Joseph, in the county of Buchanan, and JOHN DELL, residing at No. 5121 Morgan street, St. Louis, State of Missouri, citizens of the United States, have invented certain new and useful Improvements in Recuperators of Furnaces Especially Applicable to the Heating of Gas-Retorts; and we 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.

Our invention has for its object the construction of the recuperators of furnaces especially applicable to the heating of gas-retorts; and the object of our system of tiling is for the abstraction of the waste heat of the outgoing gases.

Among the leading features of our present invention is to get an effective heat-absorbing surface, and we make the parts not only of thin material, but yet strong enough to support the weight from above.

Figure 1 is a detached view in cross-section of the air-heating tile. Fig. 2 represents vertical sections, somewhat enlarged, of a portion (between lines R and S of Fig. 3) of some of the air and smoke passages. Fig. 3 is a vertical elevation of the upper portion of the furnace, the lower portion of the same below the retorts 3 being in cross-section through the lines T U and V X of Fig. 4ª; Fig. 4, a longitudinal section of elevation of the same through the line I J of Figs. 3 and 6; Fig. 4ª, a vertical section and through the fire-pot. Fig. 5 represents sectional plans in lines C D and A B, respectively, of Fig. 3; Fig. 6, sectional plans in lines E F and G H, respectively, of Fig. 3; Fig. 7, a section through the line X Y of Fig. 3, and Fig. 8 in perspective illustrates on a somewhat larger scale some of the hollow air-heating tiles and smoke-tiles.

As our invention more particularly relates to a special construction of tiles and to the abstraction and utilization of the waste heat of the outgoing gases and to affording an effective heat-absorbing surface, we need not describe the details of construction of a furnace in general.

The brick or other main structure of a furnace is indicated at 1; 2, the smoke-flue; 3, the retorts of a bench; 4, the fire-box of the furnace; 5, the combustion-chamber; 6, air-passages leading from the hollow air-tiles to the combustion-chamber.

The tiles A (see Fig. 1) are made hollow and may be divided in three sections. On the inside of these tiles are formed projecting ribs a', which are integral with both the opposite insides of the walls of such tiles. These ribs are inclined or narrowed from their bases to their edges or extremity, so that near the center of the tile these narrowed edges may face each other and near to each other within the same chamber of the tile. Each of these tiles has thus within its hollow space two rows of projecting ribs a', affording ample means for absorbing heat from the smoke-flues and imparting it to the air in the tiles A. At the end of each tile A are projections b, extending somewhat beyond the length of the tile, and for joining each projecting end against the end of its neighbor we fill with fire-cement the space between such projections.

Tiles c (see Fig. 2) are horizontal tiles forming the bottom and top of the system of supports. At the end of these bottom and top tiles is a rabbet c'. Horizontal tiles B form intermediate vertical supports and have rabbets or grooves at their inner end, as shown. In the center of these tiles B are openings d. The top and bottom tiles c are substantially the same as tiles B, except that they have not the openings d, but are solid. The vertical tiles e are thin and are of plain or split brick. If these tiles A should break or split, the parts would be still held in position, and no serious damage would result.

J is a fuel-receiving door at the mouth of the furnace-charging hole; H, a furnace-door, as shown.

If the grate be charged with fuel and the furnace-doors H and J are closed, no cold exterior air can come to the fireplace.

The whole of the air required for combustion is admitted by any suitable or ordinary regulating-dampers at each side of the furnace, the primary air to combustion being led

through the passages beneath the grates. The secondary air is led through other channels, regulated by dampers at right and left, to the middle and under the vertical air-heating tile A. Suitable dampers are indicated at *s s* in Fig. 6. The currents of air being admitted from the front, the primary air passes backward and is partially heated before it enters underneath the grates. The secondary air after traveling backward and then halfway forward enters and passes upward through the tube composed of the hollow tiles A until reaching the top, and having become highly heated by contact with smoke-flue enters a passage extending from front to rear and enters above the furnace in a fit condition to complete combustion. The smoke or waste gases passing out under each of the lower retorts, which are indicated as at 2 in Figs. 3, 4, and 4ª, through smoke-flue 2, descend at front and are divided by the vertical air-passages. The smoke or waste gases after traveling backward and forward enter the bottom of vertical waste-gas flue 5. The air to be heated passes upward and impinges upon the many heated points of the hollow tiles, and their ribs strengthen these tiles and act as absorbers to gather heat from the smoke-flues and give it out again to the air on its way upward. By these means we get an effective heat-absorbing surface and recuperate or regenerate the heat and use it more completely than by any means known to us.

Our system of tiling has its parts, as will be seen, made of thin material, and yet strong enough to support the weight of the structure above it.

The primary air enters at P (see Fig. 6) and passes part way back, then turning and passing underneath the grate-bars through passages on each side of the furnace. The secondary air enters at O, Figs. 6 and 3, passes back and then around and forward half-way, then into the center flue, where it is distributed into and passes up through the tiles A and thence into the bench, as indicated by the arrows. The smoke comes down from the bench through the flue marked M in Figs. 4 and 5.

In Fig. 8, showing the different tiles, are clearly exhibited the air-tiles, the smoke-flues B, and their relative positions and connections, and also the rabbeting *c'* and one of the vertical tiles, each and all made and built together, as hereinbefore described.

As will be seen in the drawings, but more particularly in Fig. 8, there is a mutual dependence and interdependence between the smoke-flue and the air-tiles A, the latter by reason of their weight resting upon the rabbeting *c'*, serving to sustain the tiles B B in proper position, even when tiles *e* may break or split or fall out of place. The tiles A are therefore essential parts of this conjoint structure.

What we claim in recuperator-furnaces and in heating gas-retorts is—

1. In combination with the described smoke-flues composed of vertical tiles, and of top and bottom tile-pieces and of tiles B rabbeted as set forth, hollow heating air-tiles resting by their weight on such rabbeting and serving to support the smoke-tiles, all as set forth.

2. The described system of horizontal rabbeted tiling *c*, *c'*, B, and *e*, which in combination form channels and supports for the vertical hollow and heating tile A.

3. A system of air-flues for furnaces composed of tiles A, rabbeted or grooved tiles *c*, and B, and vertical tile *e*, whereby should a tile *e* split or break, the parts would be held in position and another tile *e* may be substituted and no serious damage result.

In testimony whereof we affix our signatures in presence of witnesses.

KERR M. MITCHELL.
JNO. DELL.

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PEARLE E. SCHLAGLE.

Witnesses to the signature of John Dell:

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J. E. ZELLWEGER.