

(No Model.)

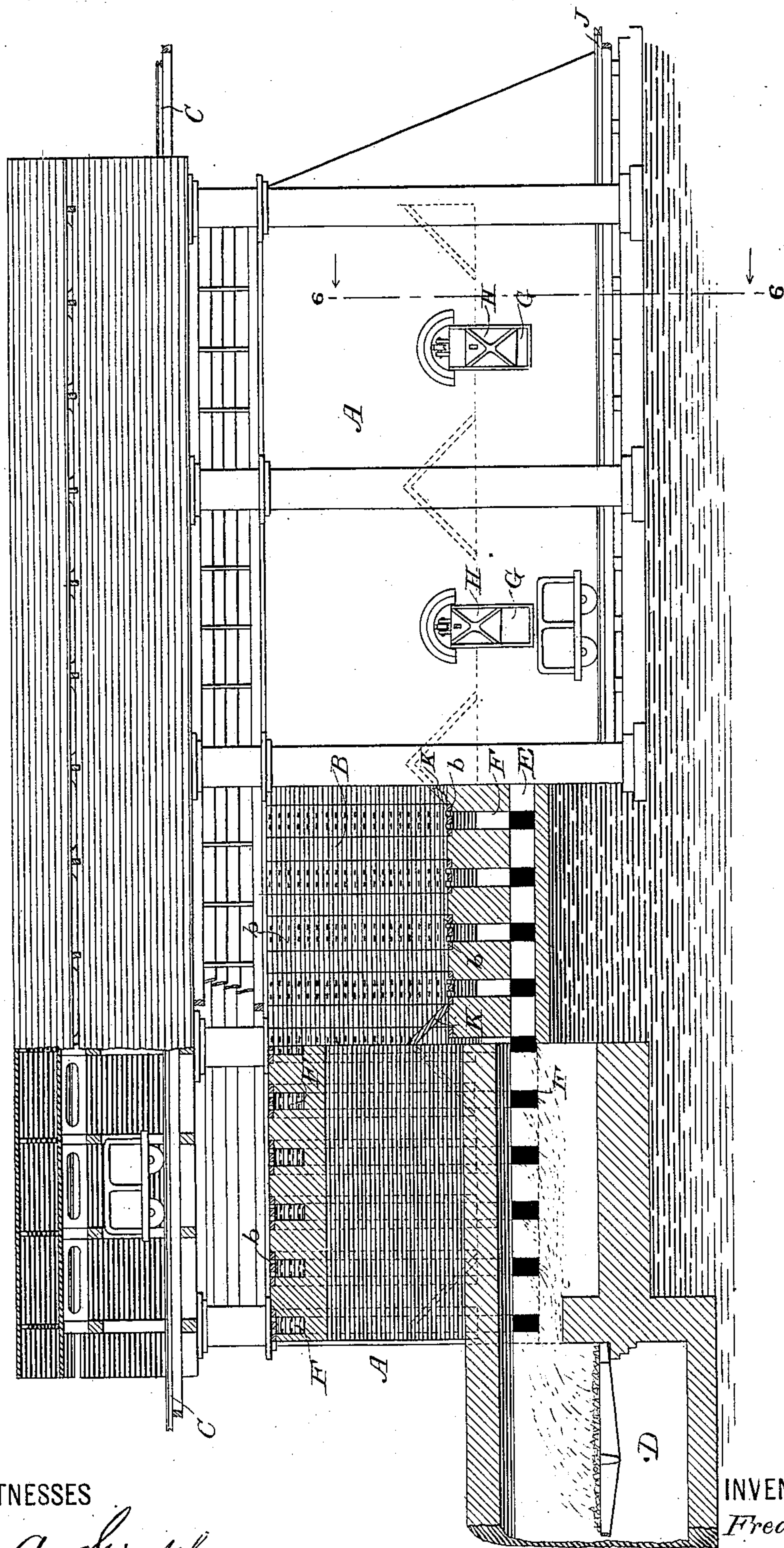
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F. BROTHERHOOD.
DRIER.

No. 308,237.

Patented Nov. 18, 1884.

Fig. 1.



WITNESSES

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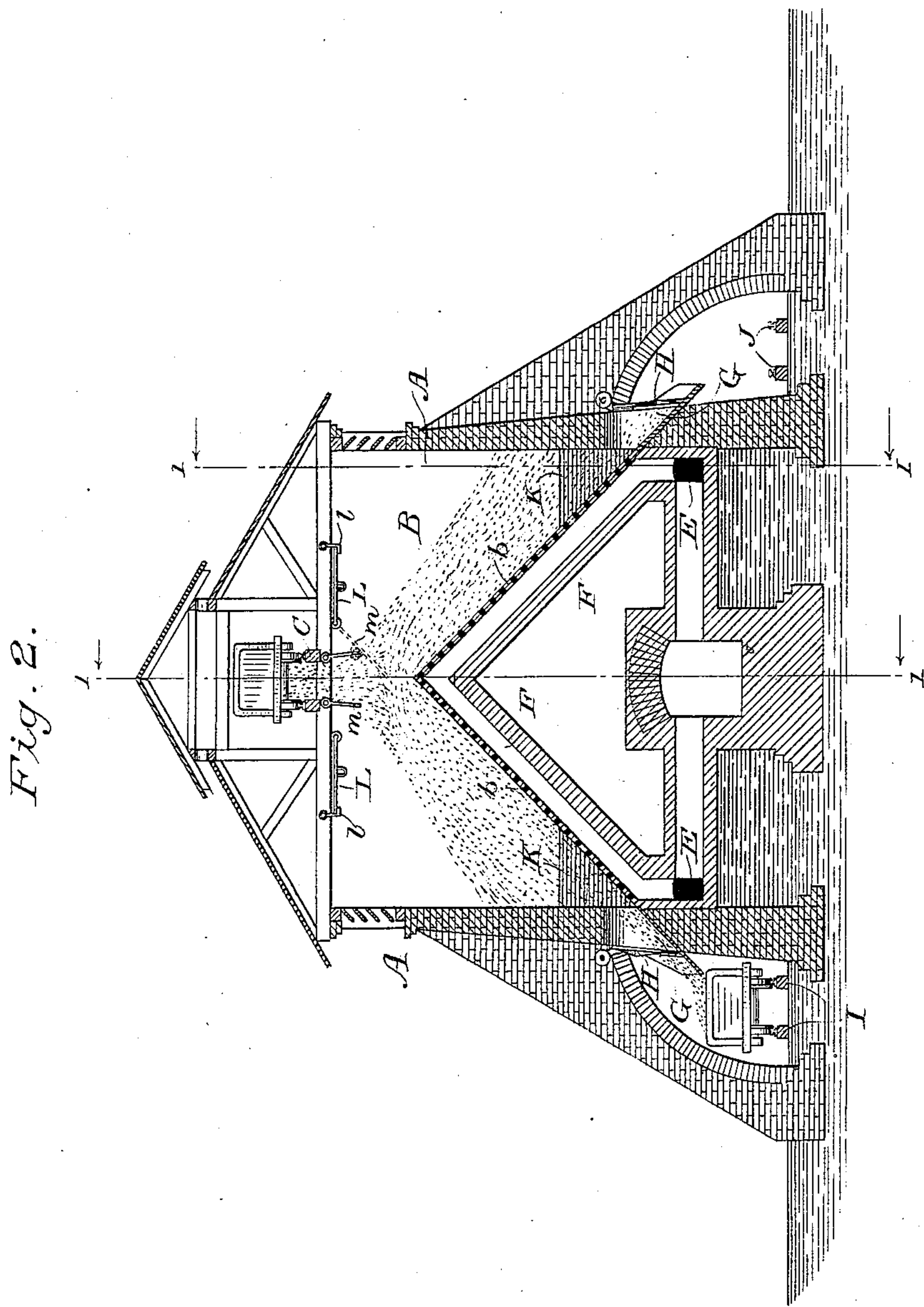
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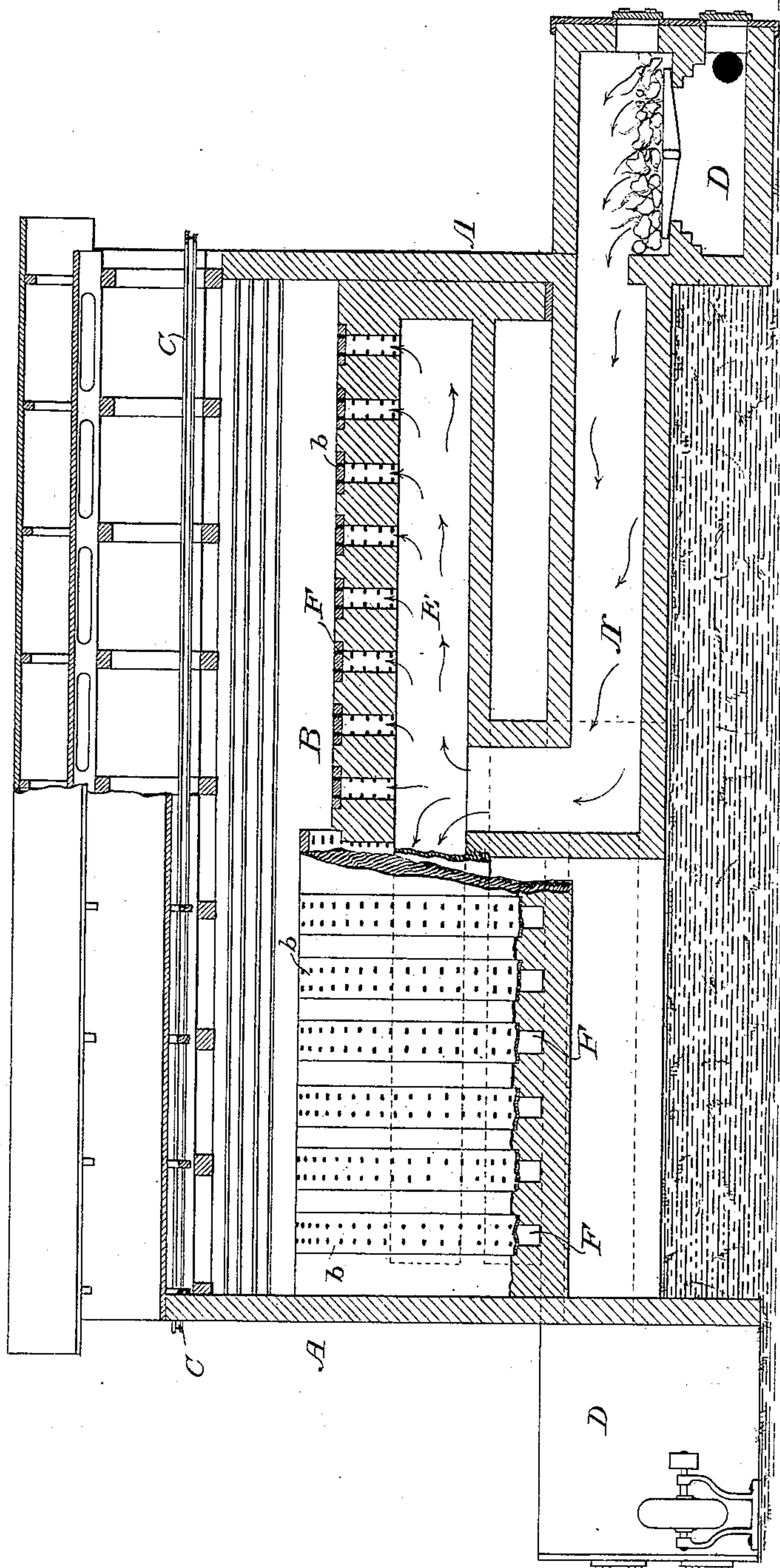
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Fig. 5



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Fig. 4.

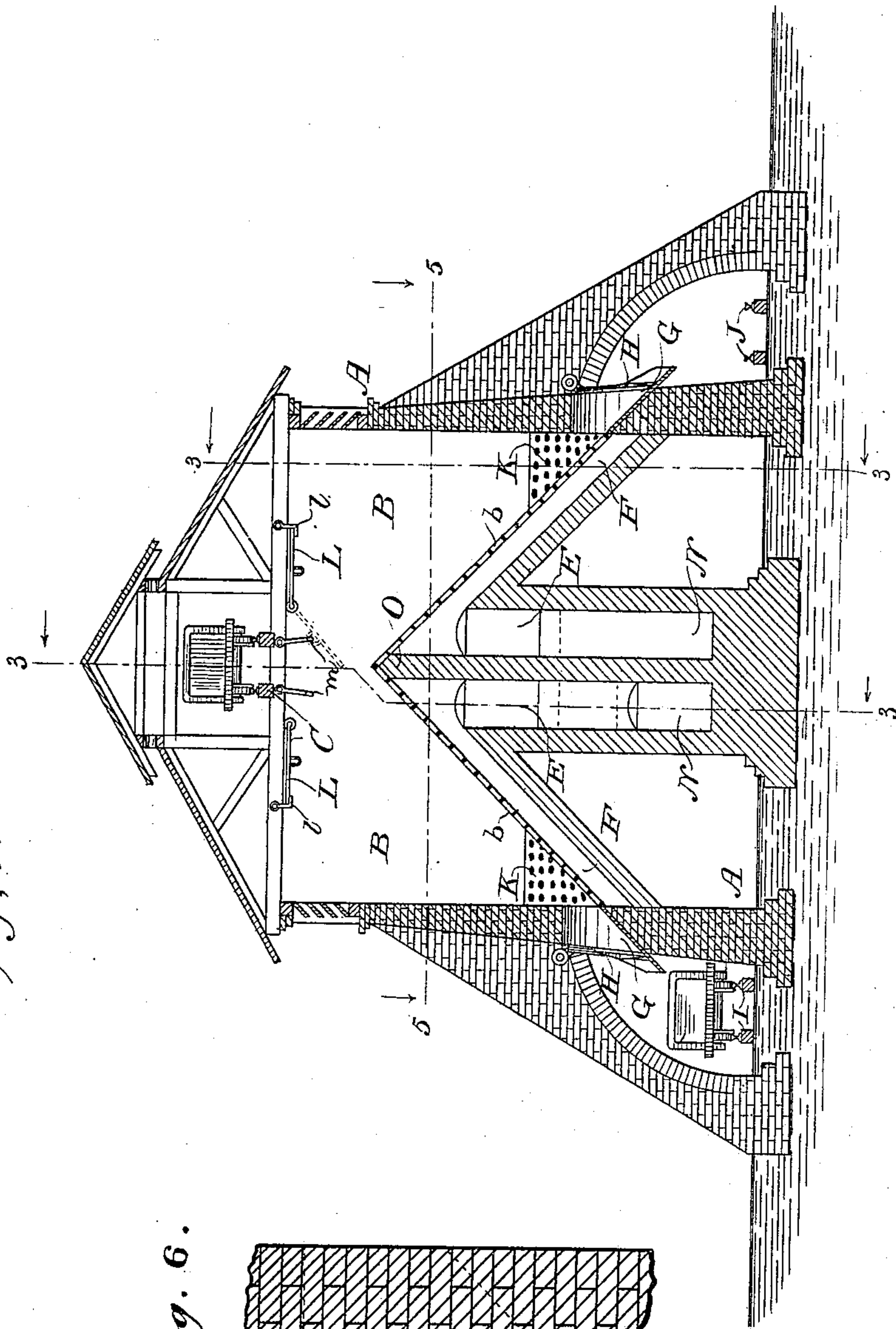
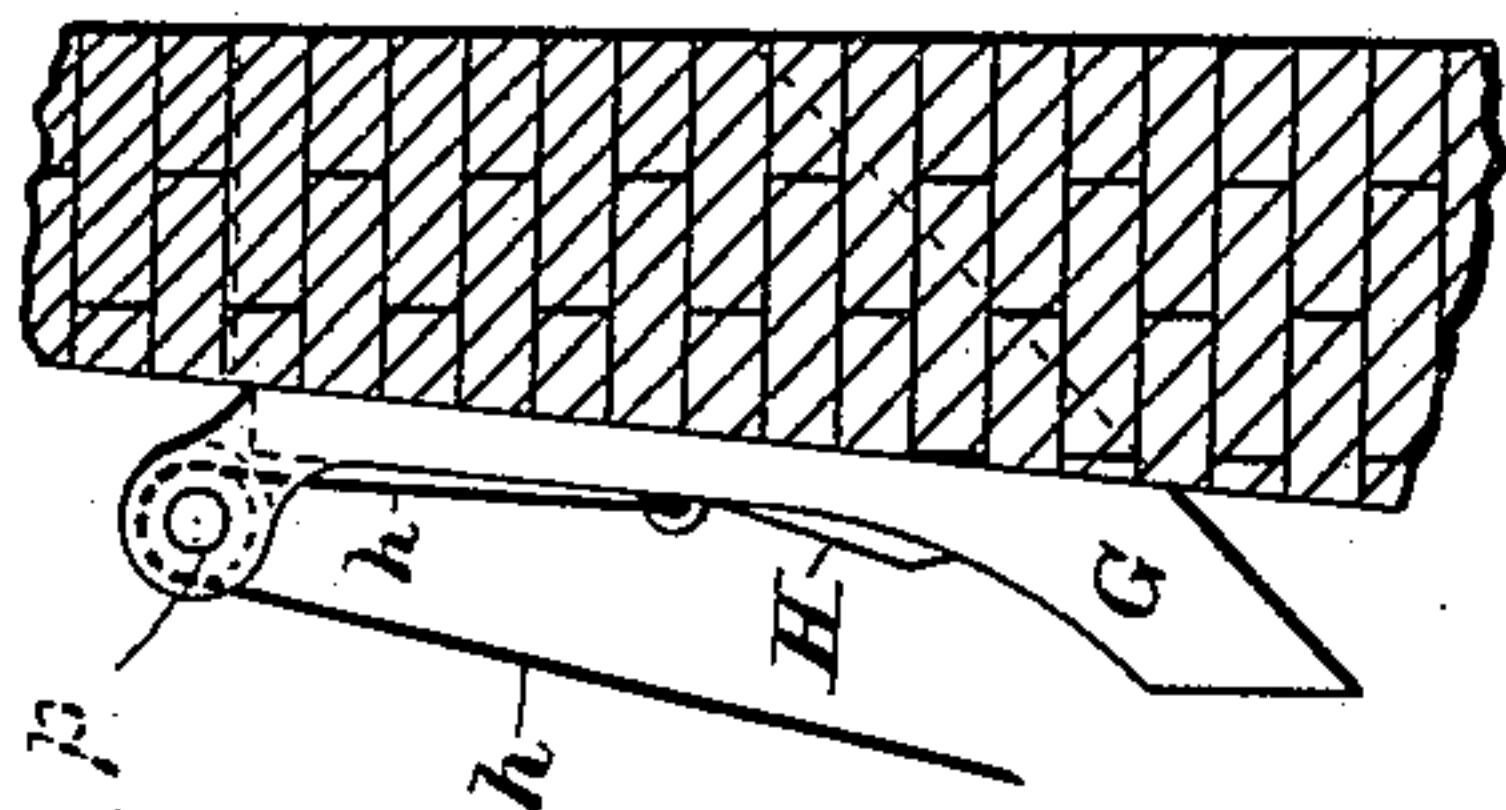


Fig. 6.



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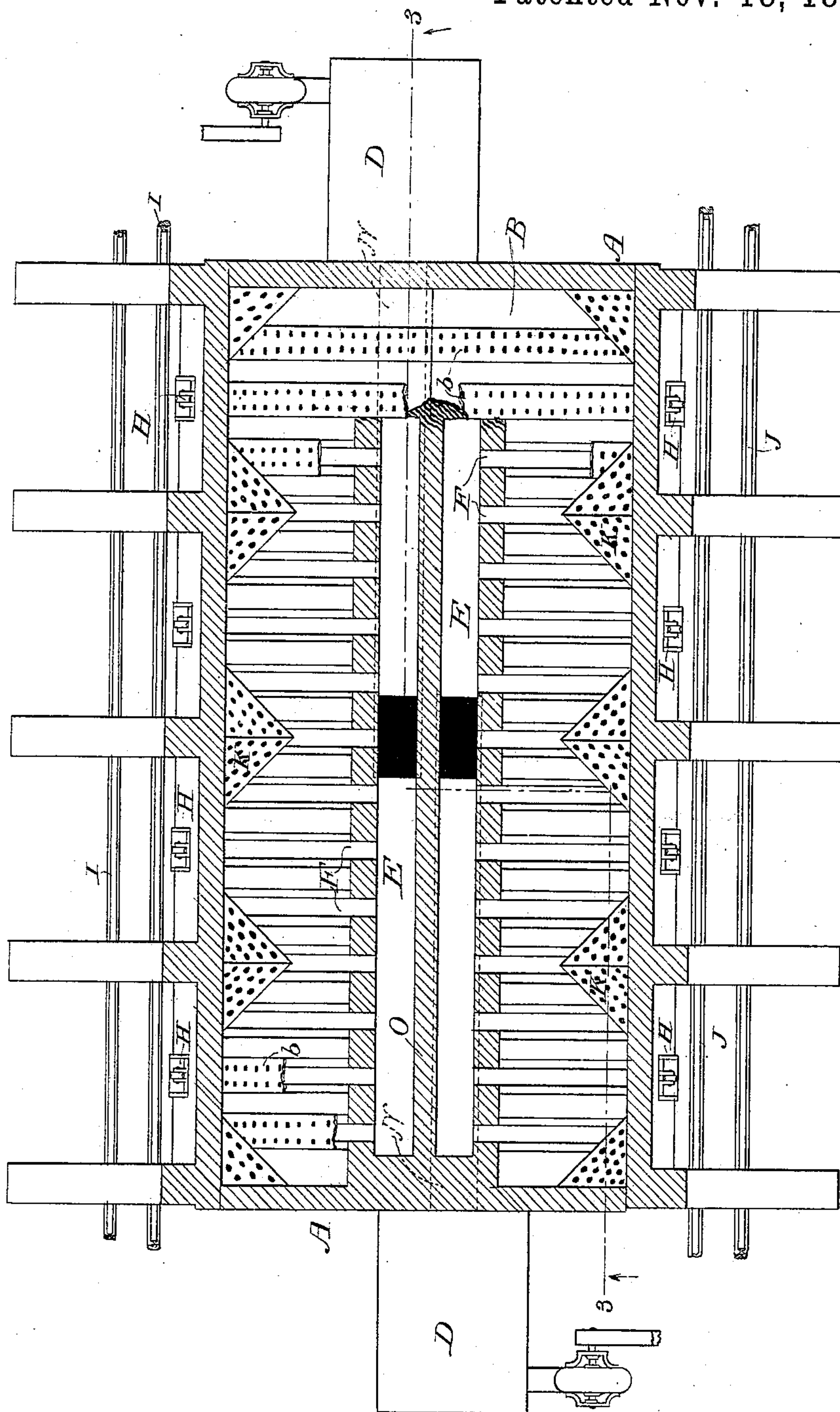
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F. BROTHERHOOD.
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5. Sheets—Sheet 5.

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UNITED STATES PATENT OFFICE.

FRED BROTHERHOOD, OF CHARLESTON, SOUTH CAROLINA.

DRIER.

SPECIFICATION forming part of Letters Patent No. 308,237, dated November 18, 1884.

Application filed January 23, 1884. (No model.)

To all whom it may concern:

Be it known that I, FRED BROTHERHOOD, of Charleston, South Carolina, have invented certain new and useful Improvements in
5 Means for Drying Phosphate Rock, &c., of which the following is a specification.

My invention relates to improvements in driers of that class which are adapted to the treatment of large quantities of the material
10 to be dried, such as ores, &c. My object chiefly is to provide means of this class by which phosphate rock may be dried in large quantities expeditiously, economically, and with least liability to damage the drier either
15 by the weight of the material being treated or by the heat required in drying it, and at the same time to so construct the drier as to provide for quickly and economically discharging the material therefrom after it has been dried.

20 In accordance with my improvements, as hereinafter to be particularly pointed out by the claims, the inclosing-walls of the drying or heating chamber of the structure are of solid or imperforate construction, (except
25 where provided with discharge-openings, which have doors for closing them,) and this chamber is provided with a doubly-inclined or centrally-peaked perforated or slotted floor, upon which the material is discharged from
30 above by the way of the open top of the drying-chamber until a sufficient quantity has been accumulated in the chamber, and at intervals along the sides of the drying-chamber, and at the bottoms of the opposite sides of its
35 incline I form discharge-openings in the walls of the structure and provide these openings with doors, by which they may be closed during the time of filling the chamber and confining and drying its contents, and then opened
40 at intervals to allow the dried material to run out by gravity, and so be loaded into suitable cars upon railways at the opposite sides of the structure. The perforations which are provided in the bottom or centrally-peaked floor
45 of the drying-chamber are formed in metallic plates, suitably secured in place, and there are beneath the perforations in the floor flues for supplying heat from side to side of the structure. These floor-flues connect with main
50 flues extending lengthwise of the structure, and by way of them communicate with a suit-

able furnace or furnaces. The heated products of combustion pass from the furnace or furnaces into the main flues, and along them into the floor-flues, from which the heat, &c.,
55 pass by way of the perforations into the material upon and above the bottom of the heating-chamber, and out by way of suitable openings at or near the top of the heating-chamber and above its imperforate inclosing-walls. 60

In the accompanying drawings, Figure 1 is a view partly in side elevation, partly in section on the line 1 1 of Fig. 2, and partly in section on the line 2 2 of said figure; and Fig. 2, a vertical transverse section of a suitable apparatus. Fig. 3 represents in vertical longitudinal section, partly on the line 3 3 of Fig. 4 and partly on the line 3 3 of Fig. 5, an apparatus differing in some respects from that shown by Figs. 1 and 2. Fig. 4 is a vertical
65 transverse section, and Fig. 5 a view showing a horizontal section on the line 5 5 of Fig. 4, some parts being broken away and other parts removed. Fig. 6 is a detail view, partly in elevation and partly in section, on the line 6 6
70 of Fig. 1.

The building or structure A is of suitable dimensions to contain a large amount of the material to be dried, which is supplied to the heating-chamber B from above. The preferable way of supplying the material to the
80 heating-chamber is by means of a railway-track, C, above the chamber, along which cars are run, and have their contents dumped into the chamber by the way of its open top, which
85 is suitably housed over or protected by a roof, as shown. The chamber has a centrally-peaked or doubly-inclined perforated floor or bottom, b. At the top of its sides, or above the solid inclosing-walls of the heating-chamber,
90 the building is shown as provided with slatted openings, in order that the surplus products of combustion, fumes, &c., may pass from the structure.

A furnace, D, or any desired number of furnaces, are provided, arranged at the end or
95 ends of the structure.

In Figs. 1 and 2 there is but one furnace shown.

Main flues E E, communicating with this
100 furnace, run lengthwise of the structure, and communicate at short intervals with the in-

clined flues F beneath the floor of the heating-chamber. These floor-flues F are covered by perforated or slotted metallic plates.

In the imperforate walls of the structure at intervals along its sides, and at the bottoms of the sides of the doubly-inclined perforated floor of the heating-chamber, discharge-openings G are provided. There are suitable doors, H, for closing these openings. These doors are made of metal and are quite heavy. As shown, sliding doors are employed, and are opened by being lifted by means of chains *h*, passing around pulleys *p*, secured above the doors, the chains being fastened to the doors and hanging down within reach of a person from the outside of the structure, so that when the material is to be discharged from the heating-chamber the doors may be opened, and when the discharge is to be stopped they may be allowed to close by gravity, as will readily be understood.

On the sides of the structure there are railway-tracks I J, upon which are run cars, into which the material is discharged from the heating-chamber, and carried off to the place of deposit—for instance, to a wharf at which a vessel lies, or to trains of cars.

In order to facilitate the discharge of the material from the heating-chamber by way of the discharge-openings, and to prevent portions of the material from remaining at the bottom of the inclines between the discharge-openings, I provide auxiliary inclines K, the direction of inclination of which auxiliary inclines is at right angles with that of the perforated floor of the heating-chamber. In order that the area of heating-surface may not be lessened by the employment of these auxiliary inclines, they are by preference provided with perforations, and as the cavities beneath them communicate with the floor-flues by way of their perforations it is obvious that the heated air, &c., will pass out of the perforations in the auxiliary inclines to the material to be dried. (See Figs. 4 and 5.)

By the employment of bottom-dumping cars for supplying the material to the heating-chamber both sides of the chamber may be supplied alike or one side only supplied, the stream of falling material being divided at the peak of the floor of the chamber, and directed to both sides, unless it is desired to direct it to one side only, in which event adjustable chutes L are arranged to intercept the material, which would otherwise pass down on one side of the peak of the floor, and direct it to the opposite side. As shown, the chutes are hinged in place and are held up out of the way by short hooks *l*, while longer hooks *m* serve to secure the chutes in inclined positions at either side of the opening at the top of the heating-chamber, through which the cars dump their contents. If preferred, side-dumping cars may be employed and the chutes dispensed with, the contents of the cars being directed to either side of the chamber, as desired.

In this way it will be seen that after the

dried material at one side of the structure is removed this side may be again supplied, so that the fresh charge may be drying while the material at the other side is being discharged.

In Figs. 3, 4, and 5 is shown a construction differing in some respects from that above in detail described. By the changes made I am enabled to provide against waste, and avoid unnecessarily heating the apparatus by cutting off the supply of heat to either side of the heating-chamber in event of such side being empty or its contents fully dried, and this may be done without interfering with the supply of heat to the other side. I also provide for a more uniform diffusion of heat to the floor-flues. In all respects, except as now to be described, the apparatus is the same as before fully set forth.

There are two furnaces, D D, at the ends of the structure, and each communicates by a conducting-flue, N, with its main flue E, there being two main flues—one for each furnace. The products of combustion pass by way of the conducting-flues N—one for each furnace—to the respective main flues, which are arranged near the peak of the floor, and have no connection with each other, being separated by the longitudinal central partition, O. The conducting-flues communicate with their respective main flues about midway their lengths, and in this way is insured a proper diffusion of the hot air, &c., as forced through the flues by suitable blowing apparatus in well-known way. The floor-flues F at one side of the heating-chamber have no connection with those of the other side. By these means, as will readily be understood, the opposite sides of the heating-chamber are independently heated, so that the material may be dried at one side at a time, or at both sides, and the supply of heat to either side of the chamber, when empty, be stopped by arresting the action of the blowing apparatus and slowing down the fire in the furnace for such side.

From the above description it will be seen that by my improvements the phosphate rock (or the equivalent thereof) may be confined in large quantities as long as needed for drying in the heating-chamber, that the heated products of combustion entering to the material to be dried through the bottom of the chamber are caused to thoroughly permeate the mass of material on the way to escape at the outlets above the material and over the solid confining-walls, and that the result is that the material may be dried and discharged from the drying-chamber and carried off with great expedition and economy, and especially so as compared with driers in which are employed perforated tubes projecting above the bottoms of the drying-chambers, and thus not only being liable to serious injury by the material as discharged into the drying-chamber, and by the weight of the material after filling the chamber, but also being in the way of the free discharge of the material after it is dried.

I am aware that it is not new, broadly con-

sidered, to provide a drier with a heating-chamber having an inclined floor and discharge-openings and their doors in the wall of the structure at the bottom of the inclined floor of the drying-chamber, and that dumping-cars have heretofore been employed to deliver material from above to drying apparatus, and I do not, therefore, unqualifiedly claim either a drier provided with an inclined floor and discharge openings and doors at its bottom, or drying apparatus to which material is supplied from above by cars or their equivalents.

I claim as of my own invention—

1. A drier provided with the heating-chamber having an open top protected by a roof, the inclined perforated floor, and imperforate inclosing-walls provided with the discharge-openings having doors for closing them, substantially as and for the purpose hereinbefore set forth.

2. The combination, with the heating-chamber having the imperforate inclosing-walls, above which the waste heat, &c., escape, and provided with the inclined perforated floor, of the floor-flues and the furnace or furnaces with which the floor-flues have communication, substantially as and for the purpose hereinbefore set forth.

3. The combination of the heating-chamber, its inclined perforated floor, the discharge-openings, and the auxiliary inclines, substantially as and for the purpose hereinbefore set forth.

4. The combination of the heating-chamber, having imperforate inclosing-walls and doubly-inclined perforated floor, the independent floor-flues for the opposite sides of the heating-chamber, the independent main flues, and the furnaces having communication with the main flues, substantially as and for the purpose hereinbefore set forth.

5. The combination of the heating-chamber, provided with a perforated floor, the floor-flues, a main flue having communication with said floor-flues, a furnace, and its conducting-flue communicating with the main flue about midway its length, substantially as and for the purpose hereinbefore set forth.

6. The combination of the heating-chamber having a perforated floor, the independent floor-flues for the opposite sides of the heating-chamber, the independent main flues, communicating, respectively, with the floor-flues for the opposite sides of the heating-chamber, the furnaces, and their respective conducting-flues, communicating with the main flues for the opposite sides of the heating-chamber about midway the lengths thereof, substantially as and for the purpose hereinbefore set forth.

In testimony whereof I have hereunto subscribed my name this 5th day of January, A. D. 1884.

FRED BROTHERHOOD.

Witnesses:

W. C. DUVALL,
EUGENE V. BROWN.