No. 700,664. Patented May 20, 1902.

M. LEE & W. W. BRYAN.

HOT AIR FURNACE.

(Application filed Mar. 22, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

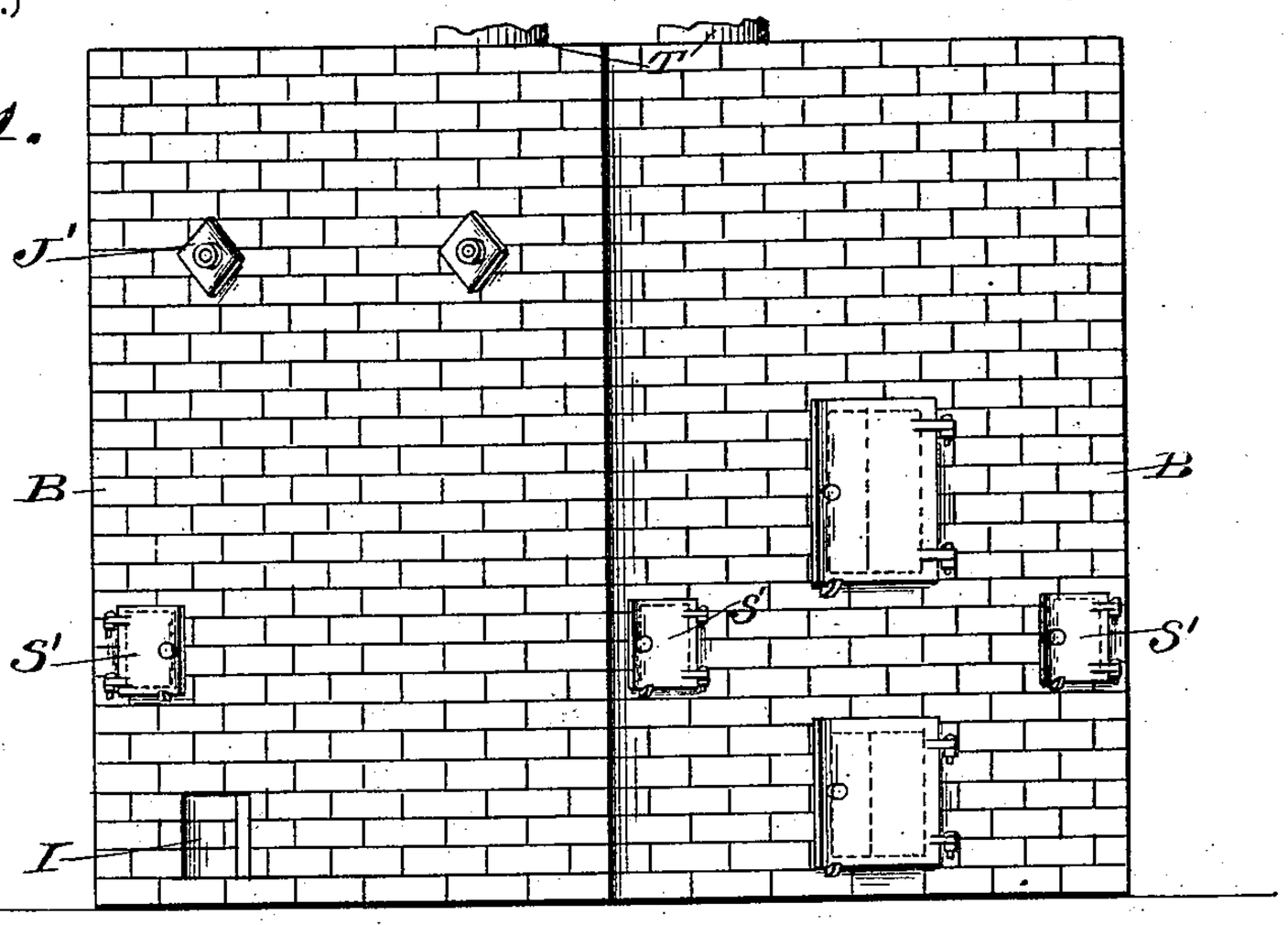

Fig. 2.

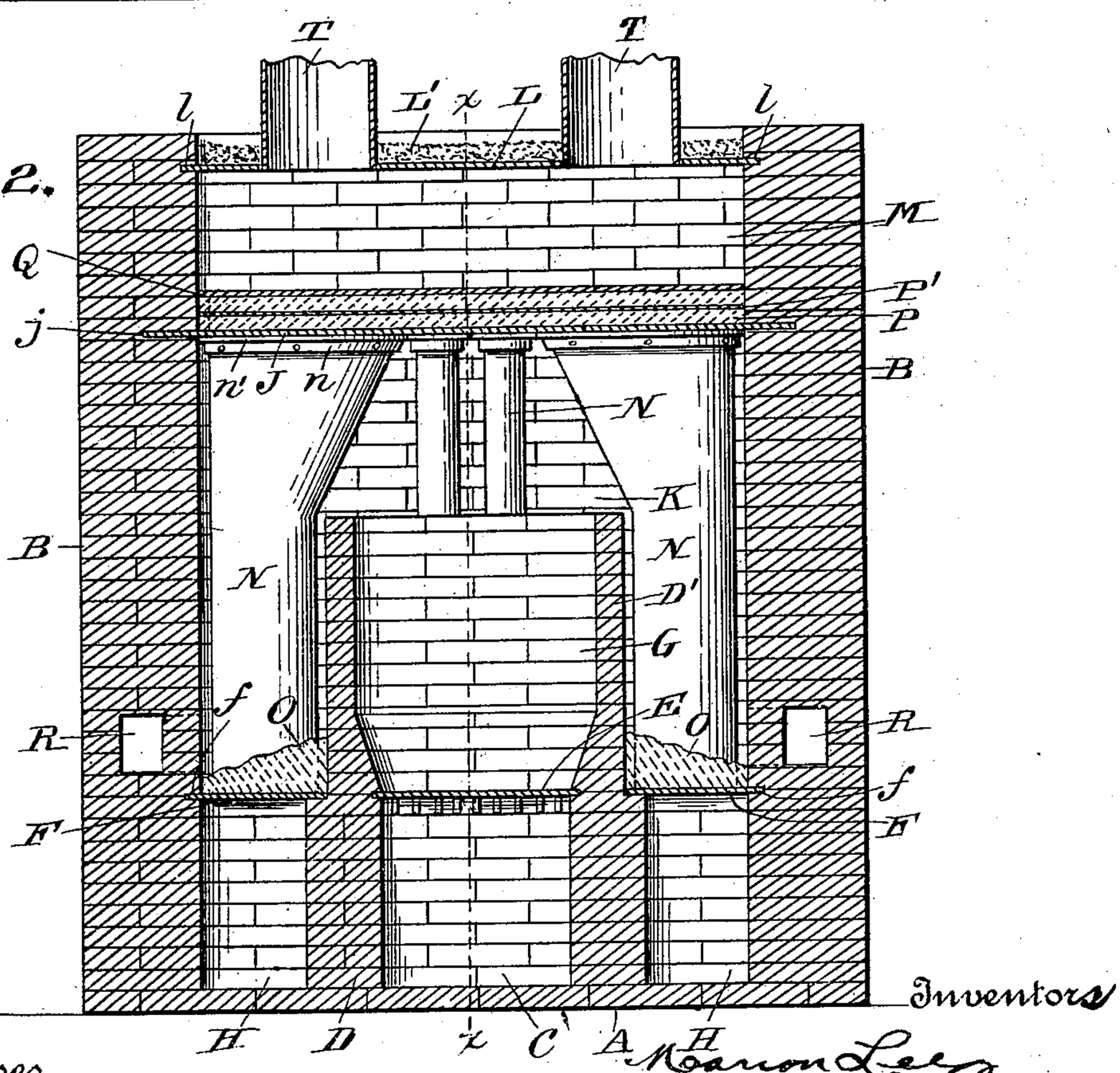

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Fig. 3.

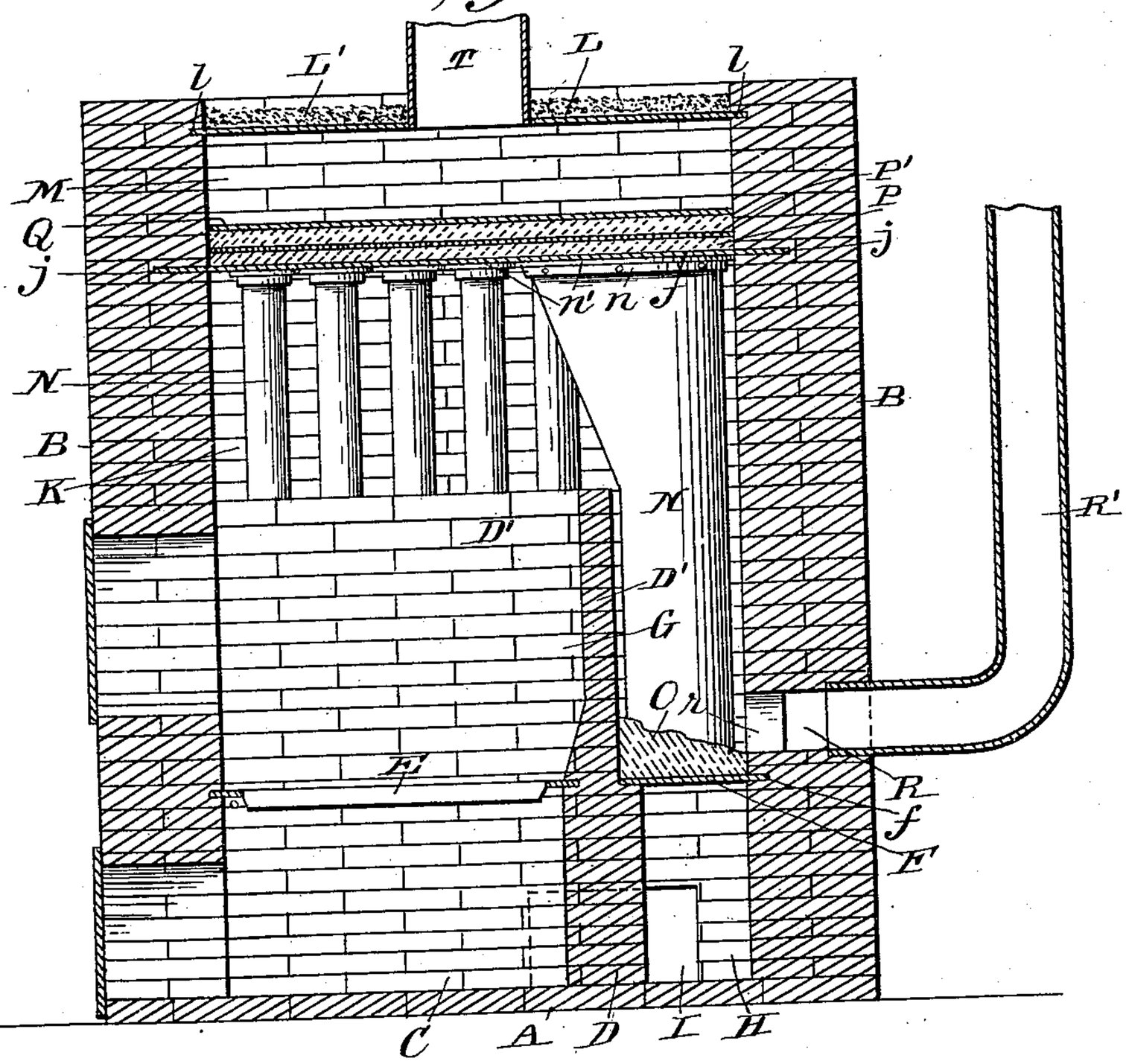


Fig. 8.

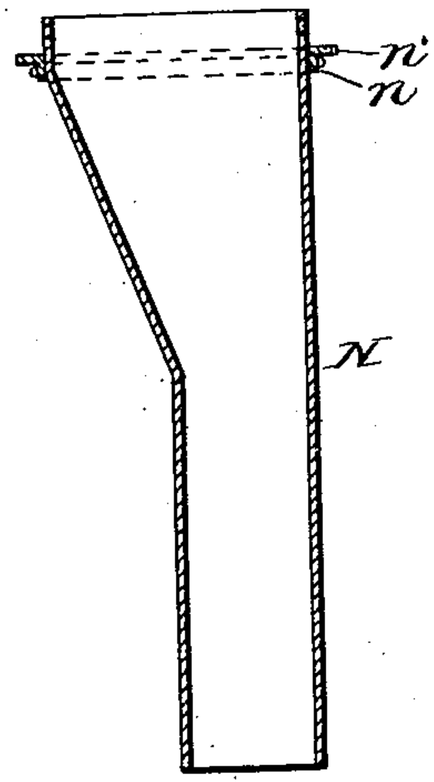
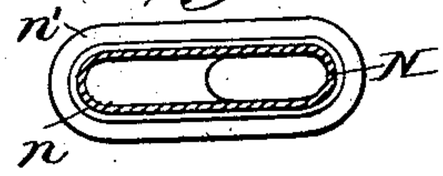


Fig. 9.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 4.

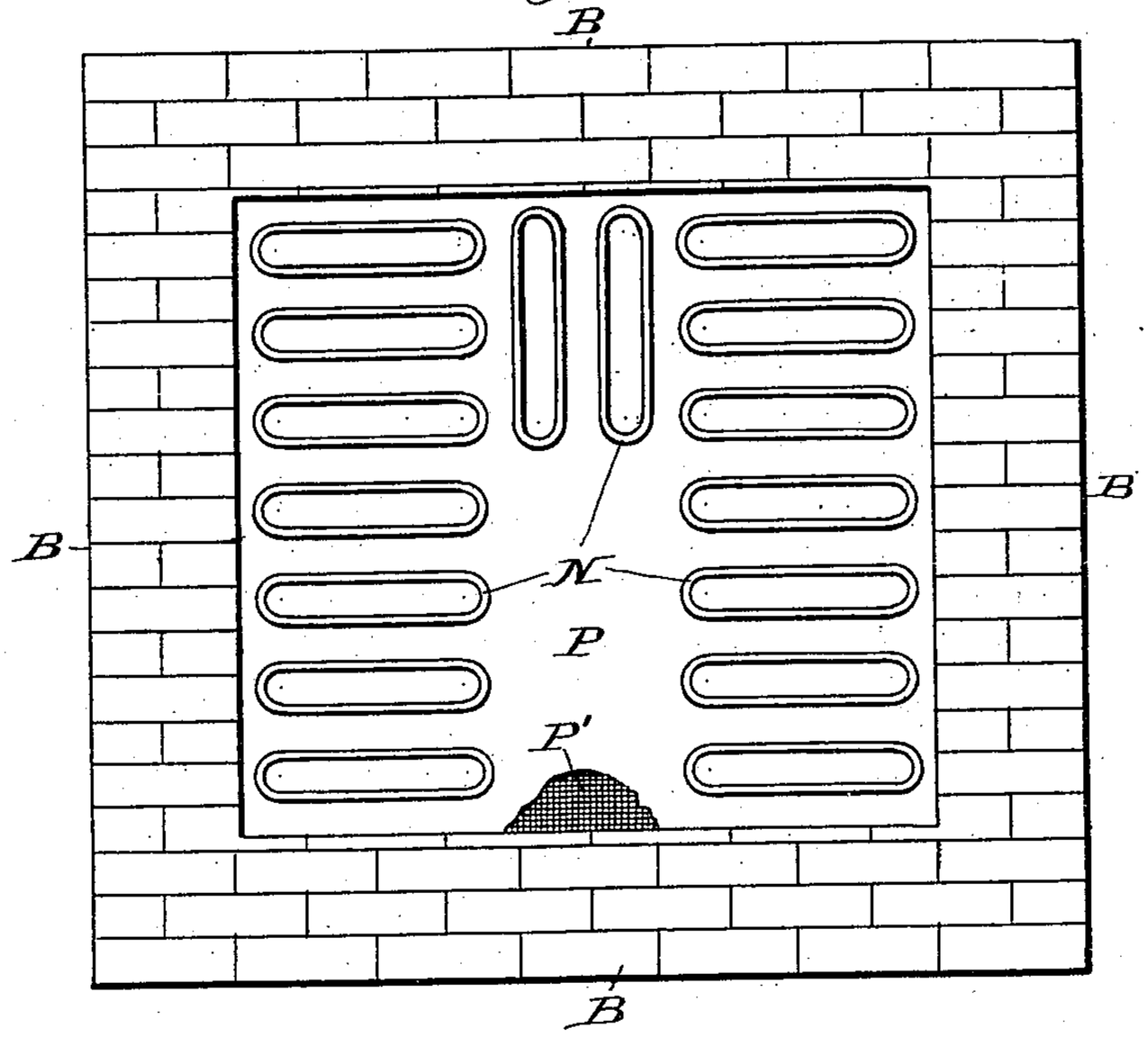

Fig. 7.

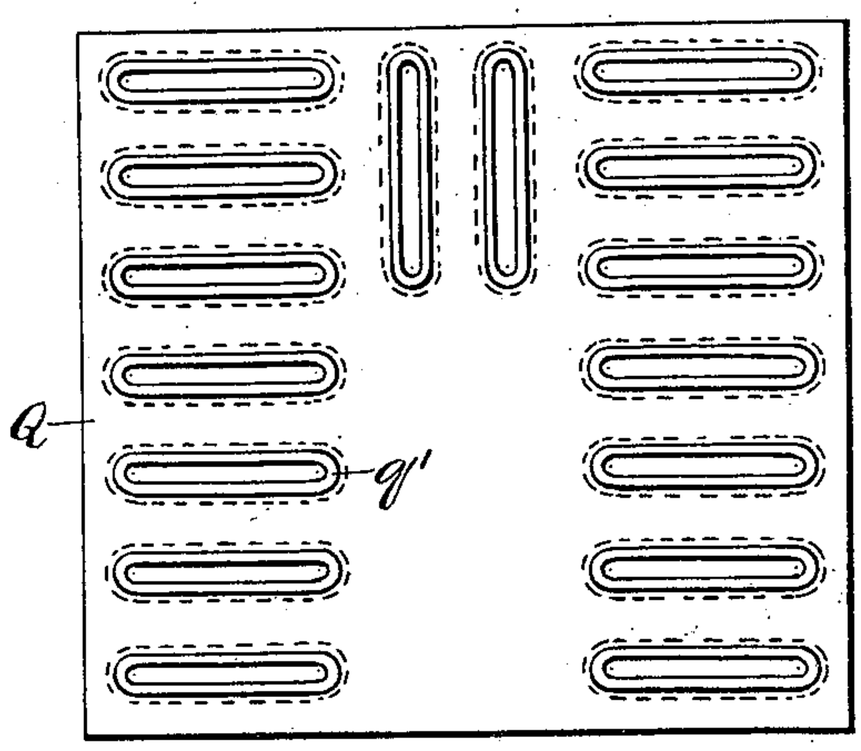

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Fig. 5.

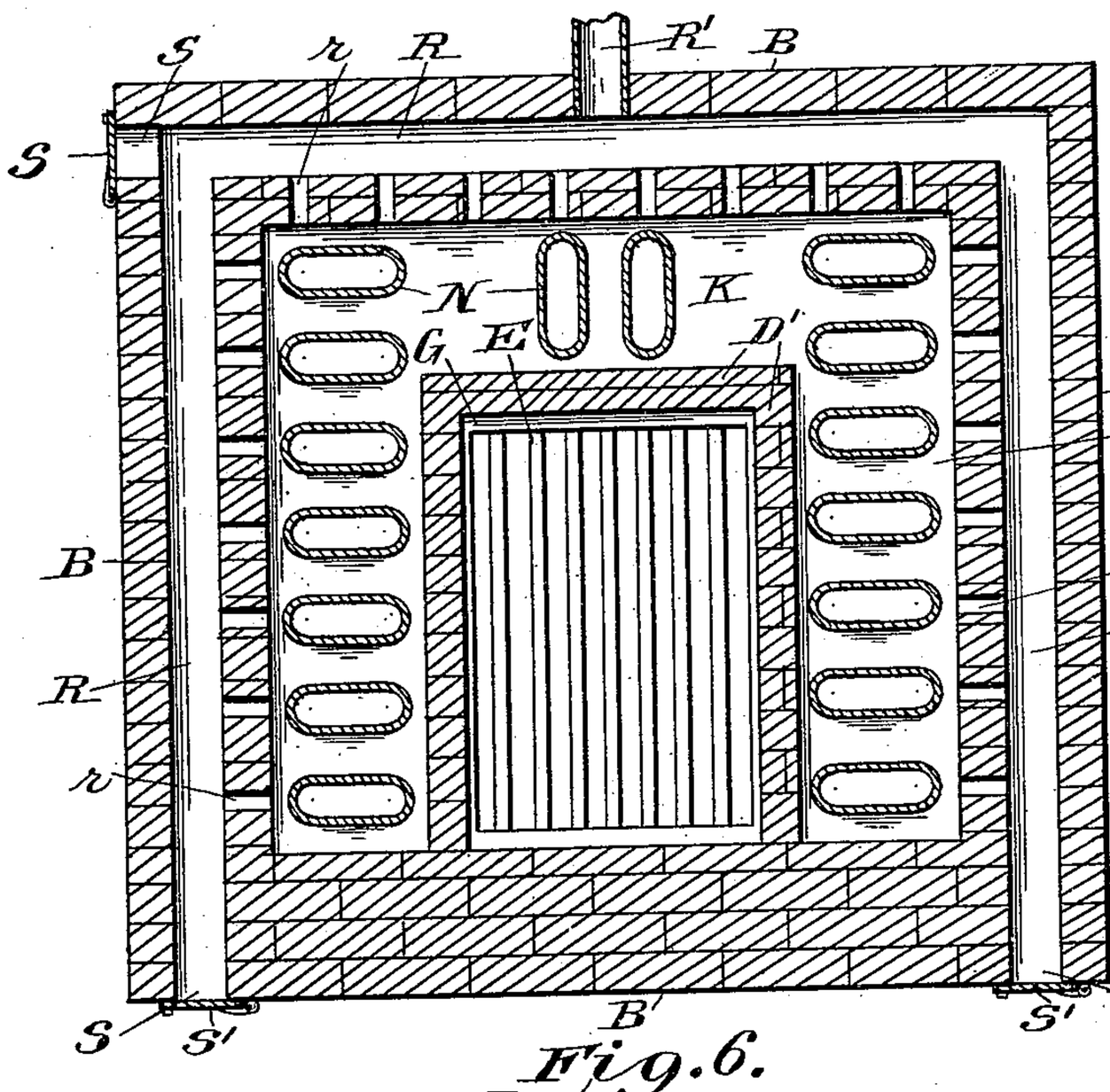
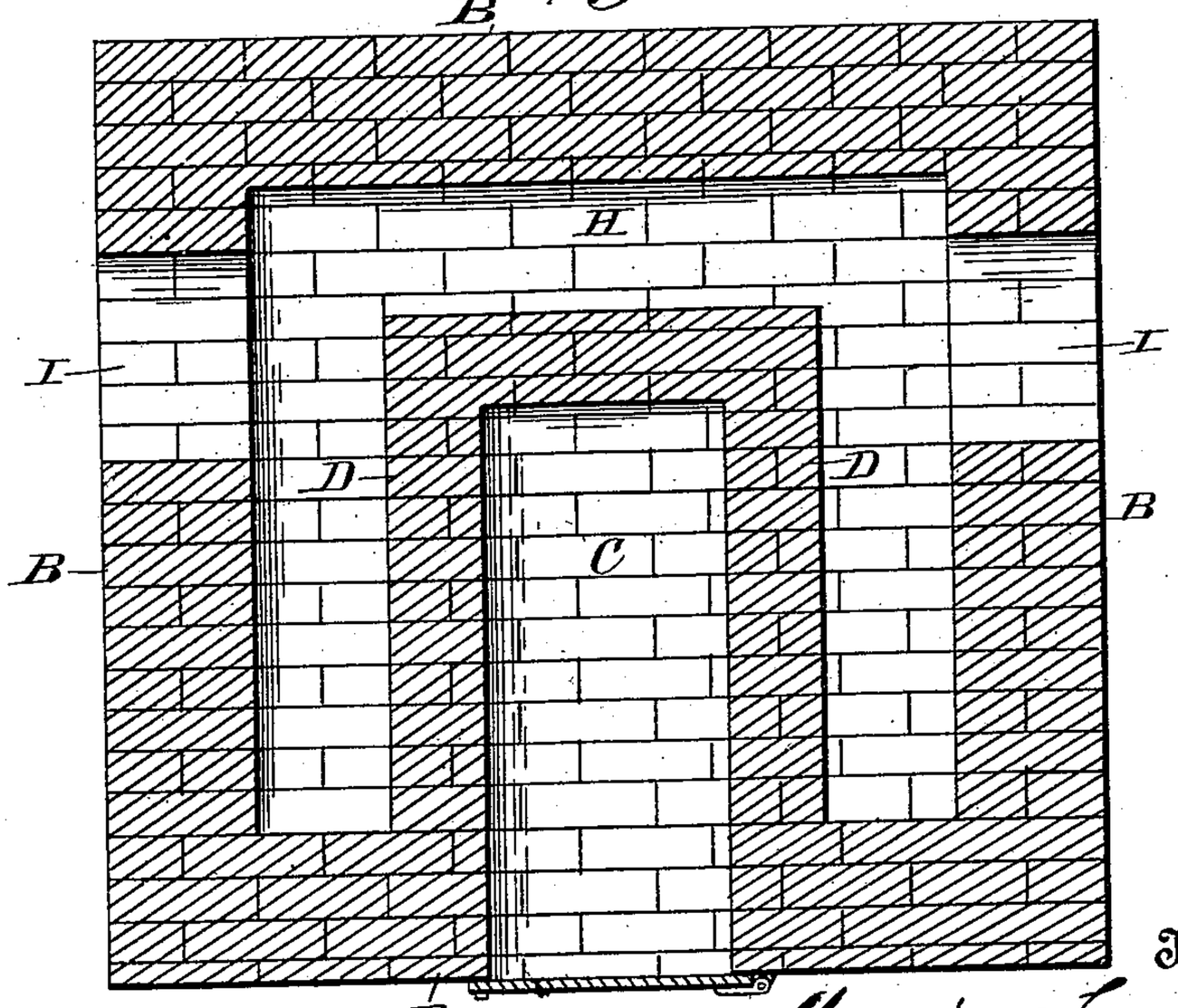


Fig. 6.



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UNITED STATES PATENT OFFICE.

MARION LEE AND WILLIAM W. BRYAN, OF ANGOLA, INDIANA, ASSIGNORS TO WILLIAM M. FANNING, OF ANGOLA, INDIANA.

HOT-AIR FURNACE.

SPECIFICATION forming part of Letters Patent No. 700,664, dated May 20, 1902.

Application filed March 22, 1901. Serial No. 52,362. (No model.)

To all whom it may concern:

Be it known that we, MARION LEE and WILLIAM W. BRYAN, citizens of the United States, and residents of Angola, in the county of Steuben and State of Indiana, have invented certain new and useful Improvements in Hot-Air Furnaces, of which the following is a specification.

The object of our invention is to provide a hot-air furnace that is easily and cheaply constructed, simple in operation, and that is so constructed as to give the largest possible heating-surface to the air, and thus get the greatest amount of heat possible from a given amount of fuel.

Referring to the drawings, Figure 1 is a view of our device in elevation, showing the front and one side. Fig. 2 is a view in elevation with the front wall removed. Fig. 3 is a section in elevation on the line *x x* of Fig. 2. Fig. 4 is a plan view of the hot-air chamber, showing the tops of the hot-air tubes. Fig. 5 is a transverse section of the combustion-chamber on a line with the smoke-flues. Fig. 6 is a transverse section of the cold-air chamber and ash-pit; Fig. 7, a detail view of asbestos covering; Figs. 8 and 9, details of the hot-air tubes.

Referring to the drawings, in which like letters of reference denote like parts throughout the several views, A represents the base of the furnace, on which are constructed the four walls, (indicated by the letter B.) The walls may be built most economically of brick, though we do not wish to be confined to this construction, as any other suitable material may be utilized, if found more desirable.

The front of the furnace is provided with the usual doors admitting to the fire-pot and ash-pit, and which are provided with the usual arrangement of drafts.

On the base interior of the four walls is constructed an ash-pit C, having its walls D at a suitable distance from the side and rear walls of the furnace. Over the ash-pit is set a grate E of any desired construction, and over the space between the ash-pit and side walls is set a plate F, made, preferably, of steel that is built into the interior walls of the furnace and the wall forming the ash-pit, as shown at *f*. The walls D are continued above the grate E any suitable distance to form the walls D′ of the fire-pot G. Beneath the plate F and surrounding the ash-pit on three sides is the cold-air chamber H, having any suitable number of cold-air ducts I. At a suitable distance above the fire-pot G a second plate J is provided, made, preferably, of steel, which is set into the walls B at *j* and made air-tight. The plate J is also supported by the anchors J′, attached thereto in any suitable manner. The space K, included between the plates F and J, comprises the combustion-chamber. Near the top of the furnace a third plate L is provided, also made, preferably, of steel, which is set into the walls of the furnace and made air-tight, as indicated at *l*, and covered with sand or gravel L′. The space M thus formed between the plates J and L is the hot-air chamber.

The plates F and J are perforated to receive the ends of steel tubes N, arranged around the sides and back of the fire-pot G at suitable distances from each other. The tubes N are made, preferably, larger at the top than at the bottom, as shown, in order to allow for the expansion of the air in heating and also to offer as large a surface as possible to the heated products of combustion. Near the upper ends of each tube N a metal ring *n* is riveted, having an outwardly-projecting flange *n′*, upon which the plate J rests. The space between the bottom of the plate J and the top of the flange *n′* is filled with fire-clay to insure an air and gas tight fit. It will be seen that the purpose of the flanges *n′* is to assist in supporting the plate J and also prevent the gas escaping from the combustion-chamber to the hot-air chamber.

Around the bottoms of the tubes N is provided fire-clay O to insure an air-tight fit and to act as a support for the tubes and the walls of the fire-pot. Fire-clay P is also provided around the tops of the tubes N, which project through the plate J a suitable distance to prevent the products of combustion entering the hot-air chamber. The fire-clay P has a fine-mesh wire screen P′ through its center to prevent cracking and breaking of the clay in expanding and contracting under the influence of the heat generated in the combus-

tion-chamber K. To further provide against a flow of gas from the combustion-chamber K to the hot-air chamber M, a layer of asbestos Q is provided, cut out at proper places for the tops of the tubes N and the edges turned down and held in the mouth of said tubes by a metal washer q'. By means of these details of construction it will be seen that the only communication between the cold-air chamber H and the hot-air chamber M are the tubes N, which, as before described, pass through the combustion-chamber K.

Around the side and rear walls B is a flue R, the bottom of which is slightly above the level of the top of the plate F and communicates with the combustion-chamber K by means of orifices r and with a smoke-stack by means of a flue R'. The combined area of the orifices r is exactly equal to the area of the flues R, and the area of the flues R is exactly equal to the area of the flue R'. This is a very important and essential feature, as by this means the products of combustion are forced to be equally distributed throughout the combustion-chamber in order to find egress, and thus all the tubes are subjected to the same amount of heat. In practice it may be found necessary to provide a flue connecting each of the flues R with the smoke-stack, and we do not, therefore, wish to be confined to the particular construction shown in the drawings. The flues R are provided with openings S, having air-tight doors S', which are intended to be used when cleaning the respective flues.

T represents the ordinary tubes for conveying the heated air to the rooms desired to be heated.

The operation is as follows: Fire is started in the fire-pot G. The smoke and gas, comprising the products of combustion, are carried upward by the walls of the fire-pot D' until they strike the plate J, where they are deflected and pass between the tubes N downward to the orifices r and out through the flues R and R' to the smoke-stack. The cold air enters through the cold-air ducts I, passes through cold-air chamber H and the tubes N, where it is heated, to the hot-air chamber M, from whence it is distributed through the tubes T to the rooms to be heated.

By our construction of fire-pot the products of combustion are forced to the upper part of the combustion-chamber, heating the plate J, and downward, by reason of the draft, to the flue-openings r, thus heating the full length of the tubes N. By this arrangement the heat is evenly distributed along the tubes, and the danger of melting or breaking the tubes by reason of a direct blast from the fire is dispensed with.

We do not wish to be confined to the exact construction shown and described, as the same may be altered somewhat without departing from the spirit of our invention.

Having thus described our invention, what we claim is—

1. In a hot-air furnace, metal plates set into the walls thereof forming a cold-air chamber, a combustion-chamber and a hot-air chamber, tubes traversing said combustion-chamber having their tops larger in area than their bottoms and extending above the floor of the hot-air chamber, a layer of clay having a wire-netting interposed therein covering the floor of said hot-air chamber to the level of the top of the hot-air tubes, a sheet of asbestos superposed over said clay, and openings cut in said asbestos over each tube having their edges turned down and held in the mouth of said tubes, substantially as shown and described.

2. In a hot-air furnace, metal plates set into the walls thereof forming a cold-air chamber, a combustion-chamber and a hot-air chamber, tubes traversing said combustion-chamber having their tops larger in area than their bottoms, a sheet of asbestos in said hot-air chamber covering the ends of said tubes, openings cut in said asbestos over the mouth of each tube, the edges of said openings turned down around the mouth of said tubes, and metal washers secured in the mouth of the tube to hold the edges of said openings therein, substantially as shown and described.

3. In a hot-air furnace, metal plates set into the walls thereof forming a cold-air chamber, a combustion-chamber and a hot-air chamber, a fire-pot in the combustion-chamber having vertically-extended walls to carry the products of combustion upward, smoke-flues interior of the side and rear walls and running horizontally therein near the floor of the combustion-chamber, and openings into said chamber to draw the products of combustion downward, substantially as shown and described.

4. In a hot-air furnace, a cold-air chamber, a hot-air chamber and a combustion-chamber, tubes connecting said cold-air and hot-air chambers, a sheet of asbestos in said hot-air chamber covering the ends of said tubes, openings cut in said asbestos over the mouth of each tube, the edges of said openings turned down and held in the mouth of said tubes, as and for the purposes shown and described.

5. In a hot-air furnace, the combination of a cold-air chamber at the base, an ash-pit therein inclosed on three sides by said cold-air chamber, a combustion-chamber containing a fire-pot having vertically-extended walls, a hot-air chamber over said combustion-chamber, tubes traversing said combustion-chamber for conveying air from the cold to the hot air chamber and heating during transit, said tubes surrounding the fire-pot on three sides and having the upper parts thereof flaring over the fire-pot, and horizontal flues in the side and rear walls of the furnace opposite the base of the combustion-chamber with outlets into said combustion-chamber, substantially as shown and described.

6. In a hot-air furnace, the combination with a cold-air chamber, a combustion-chamber and a hot-air chamber of horizontal smoke-

flues in the side and rear walls of the combustion-chamber and situated near the base thereof, and openings from said smoke-flues into the combustion-chamber, the total area of the openings in each wall being equal to the area of the plane through each smoke-flue cut at right angles to its direction, substantially as shown and described.

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

MARION LEE.
WILLIAM W. BRYAN.

Witnesses:
THAD K. MILLER,
EMANUEL KRATZEE.