May 9, 1933. F. M. MILLER 1,907,852

CHECKER BRICK SYSTEM

Filed May 21, 1931 3 Sheets-Sheet 1

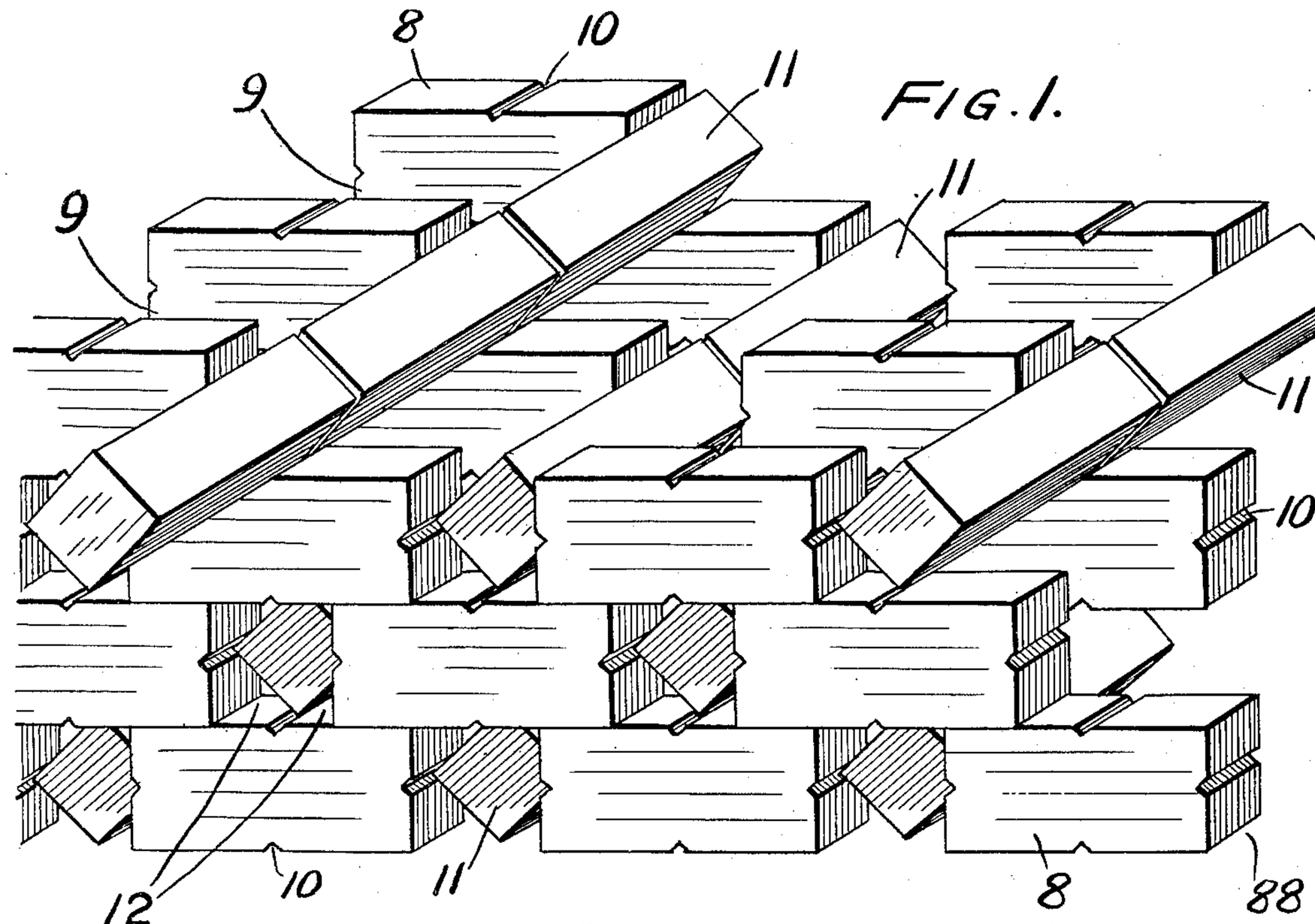

FIG. 1.

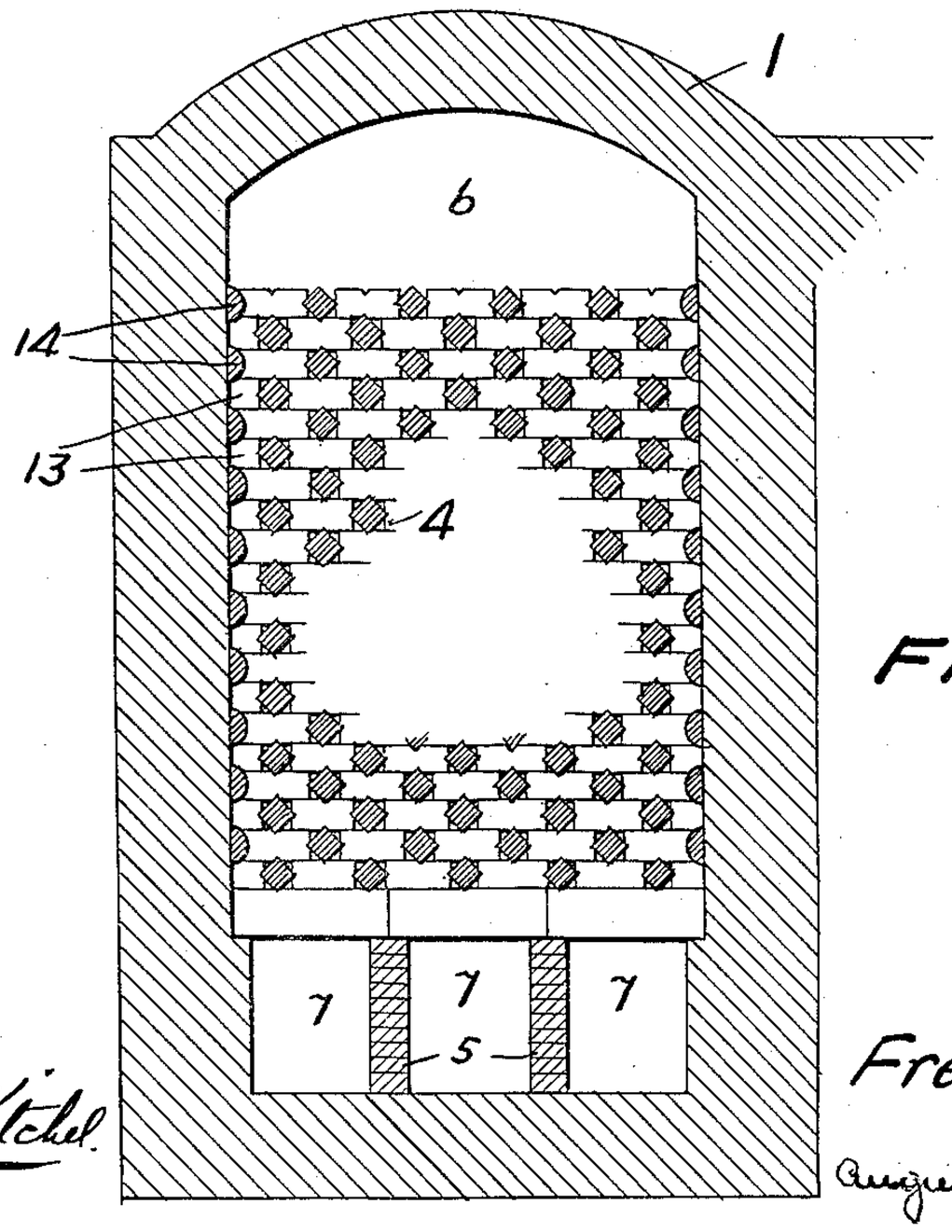

FIG. 4.

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CHECKER BRICK SYSTEM

Filed May 21, 1931 3 Sheets-Sheet 2

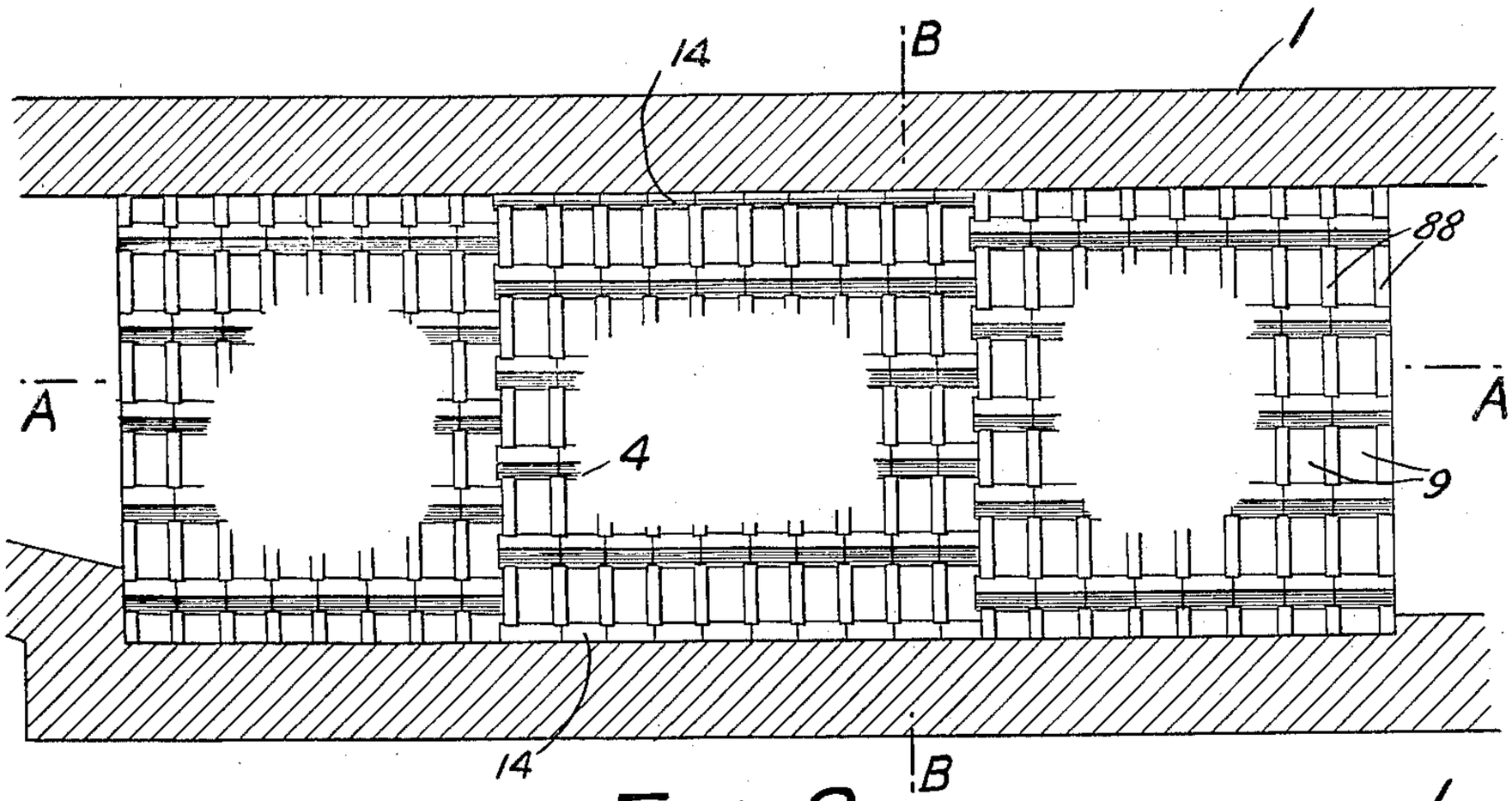

FIG. 2.

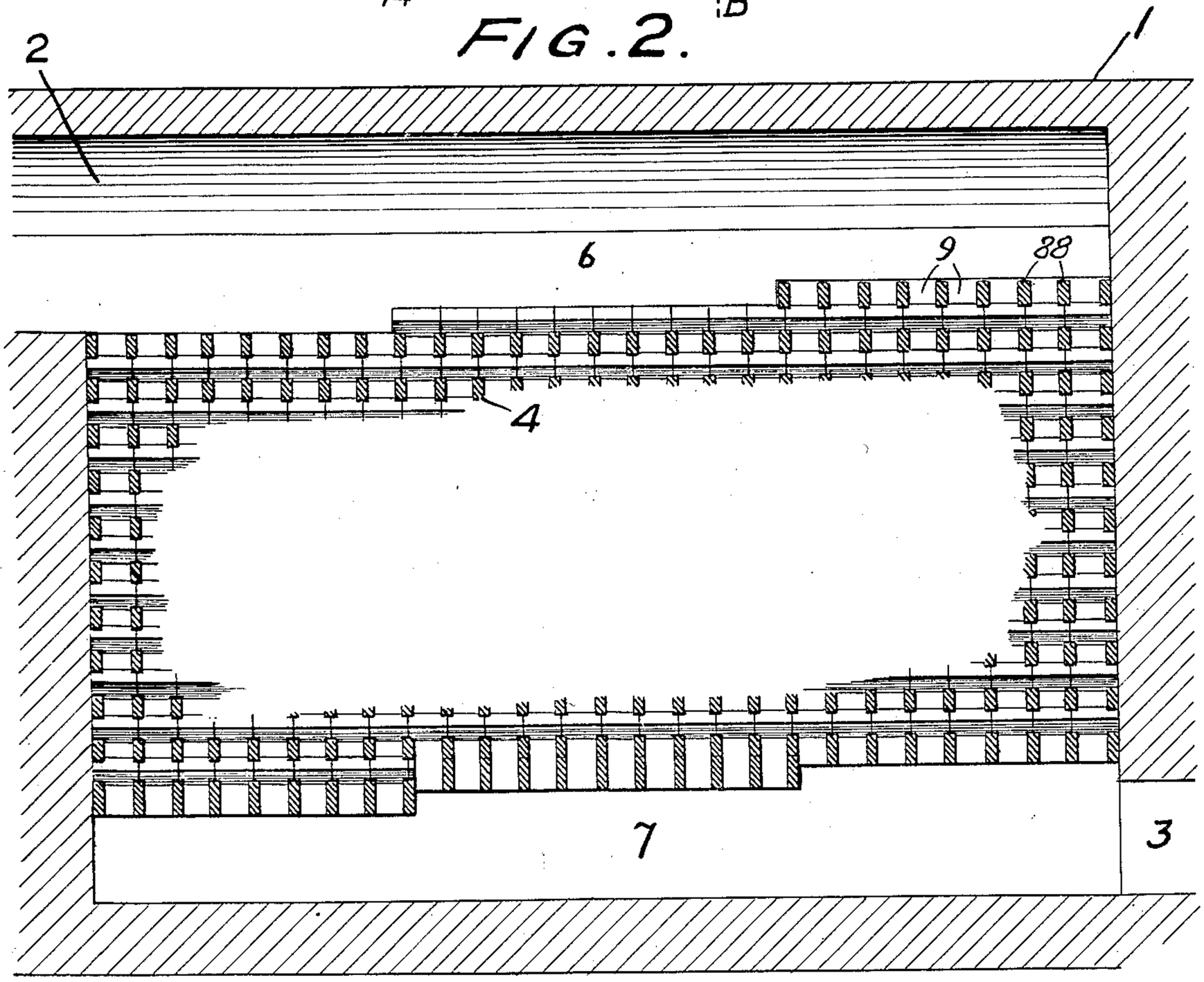

FIG. 3.

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CHECKER BRICK SYSTEM

Filed May 21, 1931 3 Sheets-Sheet 3

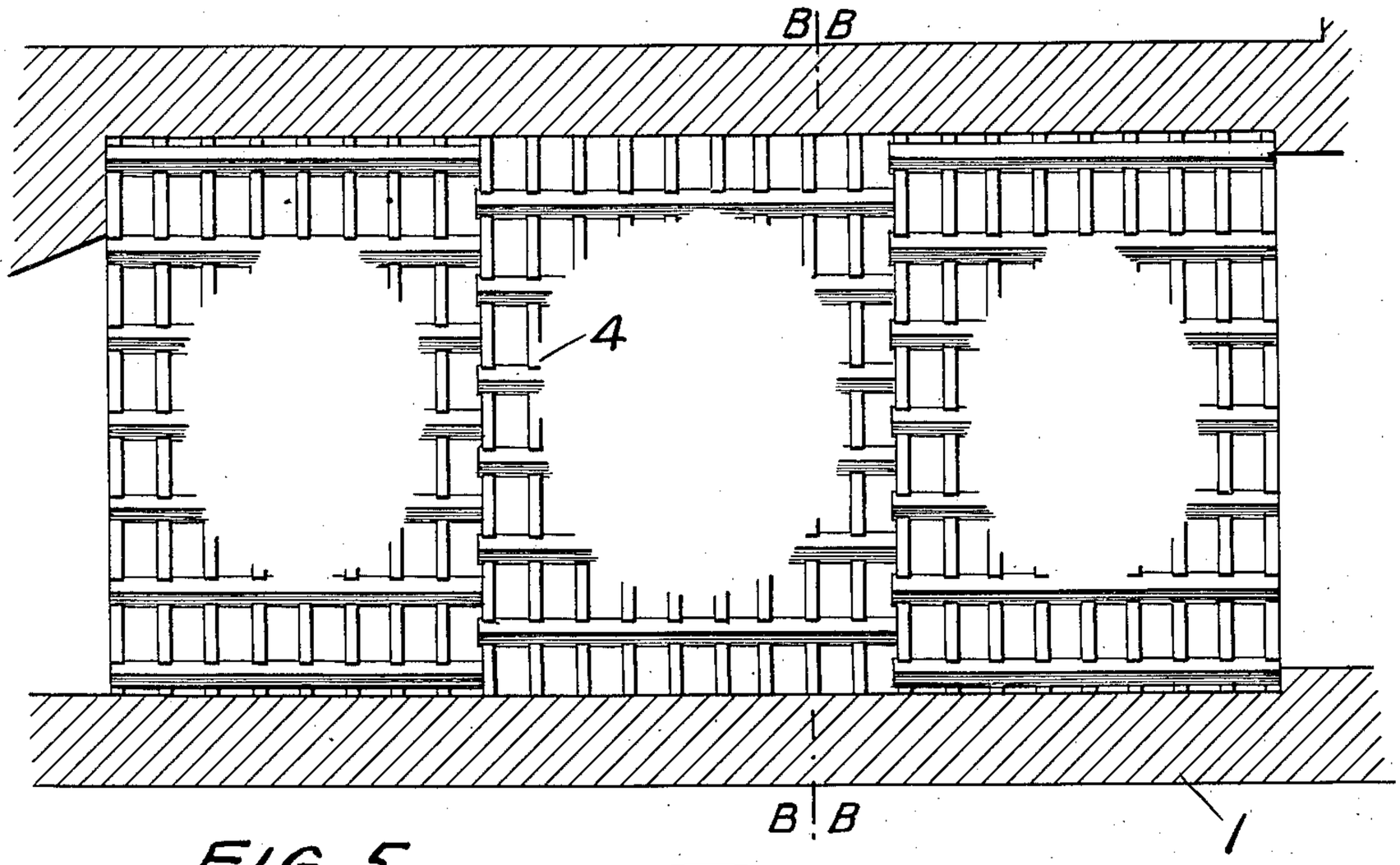

FIG. 5.

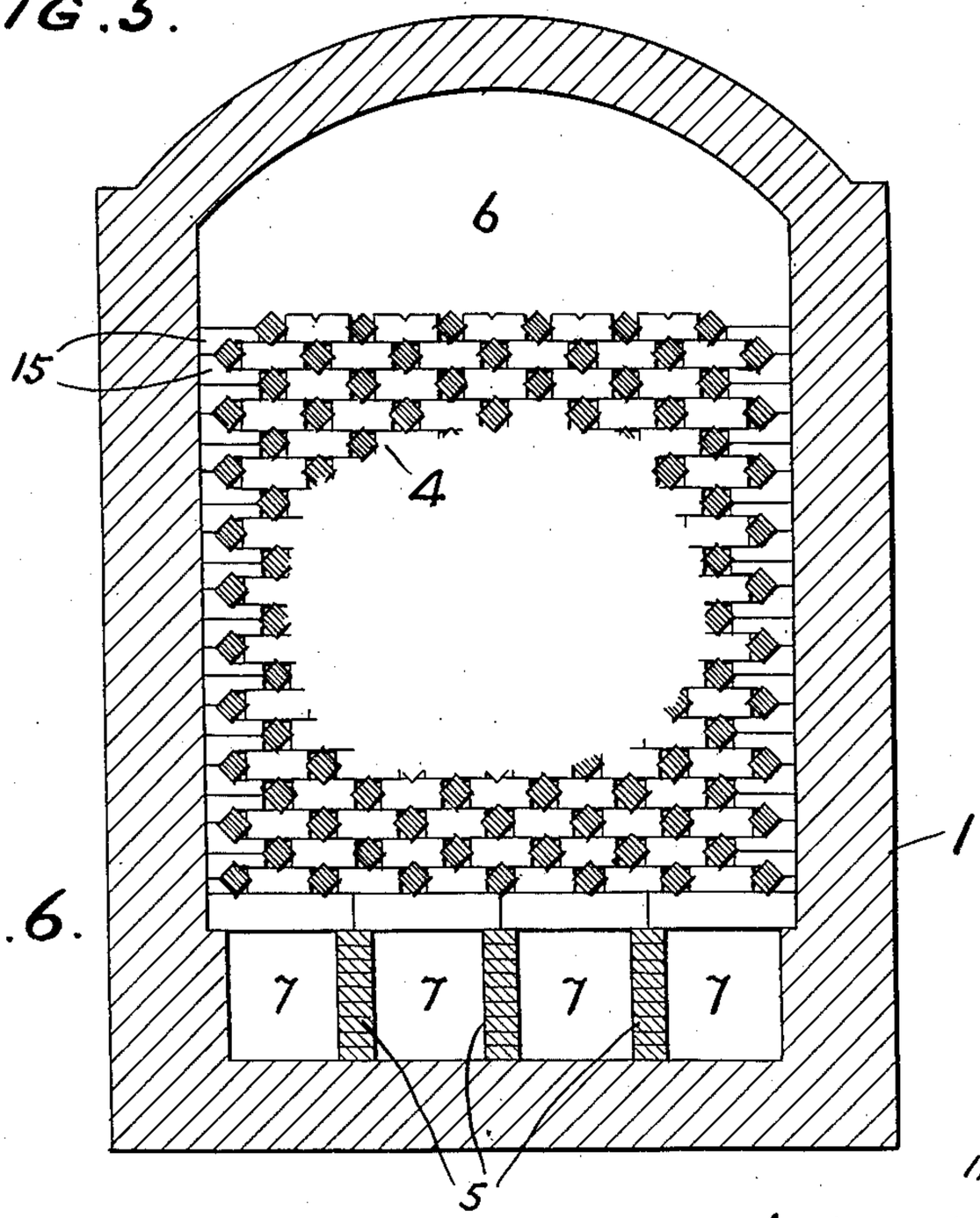

FIG. 6.

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UNITED STATES PATENT OFFICE

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CHECKER BRICK SYSTEM

Application filed May 21, 1931. Serial No. 538,908.

The subject of my invention is a checker brick system designed to give a higher efficiency than other checker systems in regenerative furnaces used in the manufacture of iron, steel, copper, zinc and other metals; glass, enamels and other chemicals and in the heating of all of these for further treatment. This will cover hot blast stoves, open hearth steel furnaces, crucible furnaces, various types of heating furnaces, glass tank and pot furnaces, various reverberatory furnaces used for both melting and heating metals and chemicals.

The best brick for checker work is the one made on a power press. This is due to the greater density of the so-called steam pressed brick over dry pressed and hand-made brick. By putting the brick through sizing machines there is added to the quality of density the important one of uniformity. When to these two properties is added mechanical strength and refractoriness, you have the ideal checker brick. This gives a strong refractory brick with smooth faces. It has strength to hold up checker work without deformation. The penetration of fluxes carried over by the gases is slight and the reaction of these fluxed with the surfaces of the brick is small. High temperatures can be reached in the chambers, due to the refractoriness of checker brick, which is made from the best clays. The sized grain structure and freedom from lamination gives a checker brick with a low spalling tendency. Uniformity of size allows checkers to be built up with the proper alignment. All this is well known to the trade.

In my improved checker system such bricks are standard sizes. This means that the consumer can be sure of prompt shipments of his brick from stock, and of a high salvage value after each campaign on his furnace. Neither of these are true with the checker systems built up from special shapes.

Another feature of my invention is the arrangement of the brick in the checker system into vertical walls at right angles to the direction of the gas flow which form flues for conducting gas between the walls. Transverse bricks are supported at their ends in the walls and extend across the flues, the alternate bricks being staggered so as to deflect or baffle the gases passing through the flues and to thereby cause turbulence of these gases which imparts more heat to the refractory bricks or extracts more heat from the refractory bricks than is the case when the flow is direct through the refractory system. At their ends the bricks which form the vertical walls and the transverse bricks define between them orifices which permit the gas to flow from one flue into another and to thereby equalize the static pressure of the gas throughout the checker chamber and consequently the temperature of the heat stored in each flue so that it is uniform throughout the refractory system.

A further feature of my invention is to arrange the checker bricks in a chamber suitable for containing them and to complete the vertical walls entirely across the chamber by means of special bricks which form end shapes and which adjust the vertical walls to the dimensions of the chamber.

Yet another feature of my invention is to arrange a checker brick system in a chamber in such a manner as to maintain approximately a uniform gas velocity in the main gas conduits feeding the checker brick system. The checker brick system is located in the central part of the chamber and spaced from the bottom and from the top walls thereof. There are thus defined passages or conduits between the top and bottom walls of the chamber and the top and bottom of the checker brick system. These conduits communicate at one end with the main flue connection and decrease in size as they extend away from the main flues. This decrease may conveniently take place by means of a change in checker brick elevation which takes place in stages or steps.

For a further exposition of my invention reference may be had to the annexed drawings and specification at the end whereof my invention will be specifically pointed out and claimed.

In the drawings,

Figure 1 is a view in projection showing the checker brick system.

Figure 2 is a plan view showing one modification.

Figure 3 is a cross section on line A—A of Figure 2.

Figure 4 is a cross section on line B—B of Figure 2.

Figure 5 is a plan view of a modified checker brick system, and

Figure 6 is a cross section on line BB—BB of Figure 5.

In the embodiment of my device chosen for illustration in the drawings, my device is shown as consisting of a chamber generally indicated as 1 which is formed of bricks or any suitable heat resisting material. In the embodiment shown, my device is intended for use with reversing furnaces although it will be apparent that my novel checker brick system is capable of use for many other purposes without the exercise of invention. At one end chamber 1 has a passage or main flue 2 which, in the modification shown, is intended for connection to the furnace and, at the diagonally opposite corner, chamber 1 has a passage or main flue 3 which is intended for connection with the stack, in the modification chosen. These passages serve as both inlets and outlets for gas depending upon the direction of flow through the checker brick system. The checker brick system, generaly indicated at 4, occupies the central part of the chamber 1 and is spaced from the bottom and from the top walls thereof. At the bottom the checker brick system is supported on piers or walls of brick 5, as is best seen in Figures 3, 4 and 6. Since the checker brick system 4 is spaced from the bottom and from the top walls of chamber 1 there are thus defined between the checker brick system 4 and the said walls conduits, generally indicated at 6 and at 7. These conduits communicate at one of their ends with the main flues 2 and 3 respectively and one of their sides are in communication with the open passages of the checker brick. In order to equalize the velocity of the gas passing through all parts of the checker system the conduits 6 and 7 decrease in size away from the passages 2 and 3 respectively. A convenient method of securing this decrease in size is to vary the elevation of the conduits 6 and 7 away from the passages 2 and 3 respectively. As is seen in Figure 3 this may conveniently be done by dividing the checker brick system 4 into sections and supporting these sections upon portions of the piers 5 of different height. This method of varying the elevation of conduits 6 and 7 is, however, merely illustrative as I may vary the dimensions of these conduits so that they decrease away from the passages 2 and 3 in any suitable manner.

Referring now more specifically to the checker brick system 4 itself it will be seen that this system is built up of a plurality of bricks 8 which are laid in courses so as to form vertical walls, generally indicated at 88. These vertical walls are spaced apart and provide between them flues generally indicated at 9 for the passage of gas through the checker brick system. The vertical walls 88 and consequently the flues 9 may extend longitudinally or laterally of the chamber 1 depending on the manner in which it is desired to conduct the gas through the checker brick system. It will be noted that, in both the modifications which I have disclosed, the flues 9 extend laterally of the chamber 1 but I do not intend to be limited in this respect as it is well known in the art to place the flues longitudinally of the chamber in constructions in which this secures a desirable result. The bricks 8 have in their sides and ends notches 10 which are shown as being V-shaped in cross section. Any other shape may be chosen if desired.

Supported at their ends in the vertical walls 88 and extending across the flues 9 there are provided transverse bricks 11 which are shown as being rectangular or diamond shaped in cross section. I do not intend to limit myself to transverse bricks of quadrilateral cross section although I prefer such bricks as the best embodiment of my invention. Nor do I intend to limit myself to bricks which are uniform throughout their lengths in cross section as the ends of the bricks may be formed of one cross section where they are received in the walls 88 and the central portion of the bricks which extend across the flues 9 may be of another cross section. Transverse bricks 11 are received in notches 10 in the sides and ends of bricks 8 so that the transverse bricks are thereby firmly locked in position in the walls 88.

An important feature of my invention is that the bricks 8 which form the vertical walls 88 and the transverse bricks 11 cooperate together to provide between them openings 12 which are shown as being triangular in cross section but whose shape depends upon the respective shapes of the bricks 8 and 11. These orifices or openings 12 are of suitable dimensions relative to the flues 9 to permit gas to pass from one flue 9 into the adjacent flues and thereby equalizes the temperature of the heat stored in the bricks defining the flues.

It will be noted that the alternate bricks 11 are staggered or located out of alinement so that the gas passing either vertically or horizontally through the flues 9 is baffled or deflected and is thereby caused to become turbulent and thus impart more heat to or extract more heat from the refractory bricks.

It is a feature of my invention that the bricks 11 present sharply sloping surfaces to the on-coming gas whether it travels vertically or horizontally. Since these surfaces slope sharply there is a greatly reduced tendency for dust to deposit on the surfaces of

the transverse bricks. My improved checker system may, therefore, be operated for much longer periods without clogging of the openings or flues.

I have indicated in Figures 2 and 4 one method of adjusting the length of the vertical walls 88 to the dimension of the chamber 1 with which the walls 88 must fit in order to complete the walls all the way across the chamber. For this purpose I provide on the ends of alternate courses of the walls 88 bricks 14 which have a rounded surface and opposite thereto a flat surface to fit against the wall of chamber 1. At the ends of the opposite alternate courses of walls 88 I provide bricks 13 which have indented or cut away rounded corners to receive the projecting rounded corners of the bricks 14. There is thus provided a continuous wall 88 completely across the chamber 1 and this wall may be accurately fitted to varying dimensions of the chamber 1 regardless of the fact that the length of bricks 8 is not an even fraction of the dimension of chamber 1.

In Figures 5 and 6 I have shown an alternate method of adjusting the length of walls 88 to the dimension of chamber 1 which they are to fit. I do this by providing bricks 15 which are generally L-shaped in vertical cross section. The width of the long arm of the L and the length of the short arm of the L is approximately half the width or height of the bricks 8. The angle between the long and short arms of the L-shaped bricks 15 is formed at an angle of approximately 45° to the long arm. It will thus be apparent, as seen in Figure 6, that when two of the bricks 15 are laid with their short arms touching they are suitable to receive one of the transverse bricks 11 therein and at their outer ends of their long arms to receive the end of one of the bricks 8. There is thus provided an alternate means for adjusting the length of the walls 88 and forming these walls continuously across the chamber 1 despite the fact that the length of the bricks 8 is not an even fraction of the dimension of chamber 1.

The word "gas" as used in this specification and claims is used in its broad sense to mean any gaseous fluid including air.

I do not intend to be limited in the practice of my invention save as the scope of the prior art and of the attached claims may require.

I claim:

1. A checker brick system including a plurality of substantially rectangular bricks arranged in vertical walls defining flues for conducting gas between the walls, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls and extending across said flues and presenting sharp edges and deflecting surfaces to gas passing through said flues, said first mentioned bricks and said second mentioned bricks defining substantially triangular orifices between them for equalizing the static pressure of the gas in the flues.

2. A checker brick system including a plurality of substantially rectangular bricks arranged in vertical walls defining flues for conducting gas between the walls, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls and extending across said flues and presenting sharp edges and deflecting surfaces to gas passing through said flues, alternate transverse bricks being staggered to deflect the flow of gas through said flues, said first mentioned bricks and said second mentioned bricks defining substantially triangular orifices between them for equalizing the static pressure of the gas in the flues.

3. A checker brick system including a plurality of substantially rectangular bricks having notches in their sides and ends and arranged in vertical walls defining flues for conducting gas between the walls, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls in said notches in the first mentioned bricks, said first mentioned bricks and said second mentioned bricks defining orifices between them for equalizing the static pressure of the gas in the flues.

4. A checker brick system including a plurality of substantially rectangular bricks having notches in their sides and ends and arranged in vertical walls defining flues for conducting gas between the walls and a plurality of substantially rectangular transverse bricks supported at their ends in said walls in said notches in the first mentioned bricks, alternate transverse bricks being staggered to deflect the flow of gas through said flues, said first mentioned bricks and said second mentioned bricks defining orifices between them for equalizing the static pressure of the gas in the flues.

5. A checker brick system for conducting gas in opposite directions, said system including a plurality of substantially rectangular bricks having V-shaped notches in their sides and ends and laid with their longer dimension horizontal forming vertical walls defining flues for conducting gas between them, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls in said notches in said first mentioned bricks, said transverse bricks being laid with one corner uppermost and one corner lowermost to present equal sloping surfaces to the flow of gas in either direction and being staggered to baffle the flow of gas through the said flues, said first mentioned bricks and said second mentioned bricks providing a plurality of triangular orifices between the bricks, said orifices serving to equalize the static pressure of the gas in the flues.

6. A checker brick system including a chamber containing checker bricks therein

and gas passages at opposite ends thereof, a plurality of bricks laid in vertical walls defining flues for conducting gas between them, bricks generally L-shaped in vertical cross section at the ends of the courses of said first mentioned bricks serving to complete said vertical walls across said chamber, and transverse bricks supported at their ends in said walls and extending across said flues, said first mentioned bricks and said last mentioned bricks defining orifices therebetween which serve to equalize the static pressure of the gas in said chamber.

7. A checker brick system including a chamber containing a checker brick work, said chamber having gas passages at diagonally opposite corners thereof, a plurality of substantially rectangular bricks arranged in vertical walls defining flues for conducting gas between the walls, a plurality of substantially rectangular transverse bricks supported at their ends in said walls and extending across said flues and presenting sharp edges and deflecting surfaces to gas passing through said flues, said first mentioned bricks and said second mentioned bricks forming the checker brick work and defining substantially triangular orifices between them for equalizing the static pressure of the gas in said chamber, said checker bricks being spaced from the top and from the bottom walls of said chamber and defining conduits between the top and bottom walls of said chamber and the top and bottom of said checker brick work respectively, said conduits communicating with said passages and decreasing in size away from said passages.

8. A checker brick system including a plurality of substantially rectangular bricks arranged in vertical walls defining flues for conducting gas between the walls, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls and extending across said flues, said first mentioned bricks and said second mentioned bricks defining orifices between them for equalizing the static pressure of the gas in the flues.

9. A checker brick system including a plurality of substantially rectangular bricks arranged in vertical walls defining flues for conducting gas between the walls, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls and extending across said flues, alternate transverse bricks being staggered to deflect the flow of gas through said flues, said first mentioned bricks and said second mentioned bricks defining orifices between them for equalizing the static pressure of the gas in the flues.

10. A checker brick system including a chamber containing checker bricks therein and gas passages at opposite ends thereof, a plurality of bricks laid in vertical walls defining flues for conducting gas between them, bricks having curved surfaces at the ends of alternate courses of said first mentioned bricks, bricks in said alternate courses adjacent said second mentioned bricks and having suitable curved surfaces contacting with the curved surfaces of said second mentioned bricks, bricks having corners cut away suitably to contact with the curved surfaces of said second and said third mentioned bricks at the ends of the other alternate courses of said first mentioned bricks, said second mentioned and said fourth mentioned bricks serving to complete said vertical walls across said chamber, and transverse bricks supported at their ends in said walls and extending across said flues, said first mentioned bricks and said last mentioned bricks defining orifices therebetween which serve to equalize the static pressure of the gas in said chamber.

11. A checker brick system including a plurality of substantially rectangular bricks arranged in vertical walls defining flues for conducting gas between the walls, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls on the sides of and intermediate the corners of said first mentioned bricks and extending across said flues, the side surfaces of said second mentioned bricks being tilted relative to the supporting surfaces of said first mentioned bricks defining orifices between them for equalizing the static pressure of the gas in the flues.

12. A checker brick system including a plurality of substantially rectangular bricks arranged in vertical walls defining flues for conducting gas between the walls, and a plurality of substantially rectangular transverse bricks supported at their ends in said walls on the sides of and intermediate the corners of said first mentioned bricks and extending across said flues, alternate transverse bricks being staggered to deflect the flow of gas through said flues, the side surfaces of said second mentioned bricks being tilted relative to the supporting surfaces of said first mentioned bricks defining orifices between them for equalizing the static pressure of the gas in the flues.

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