

No. 742,740

PATENTED OCT. 27, 1903.

J. REULEAUX.

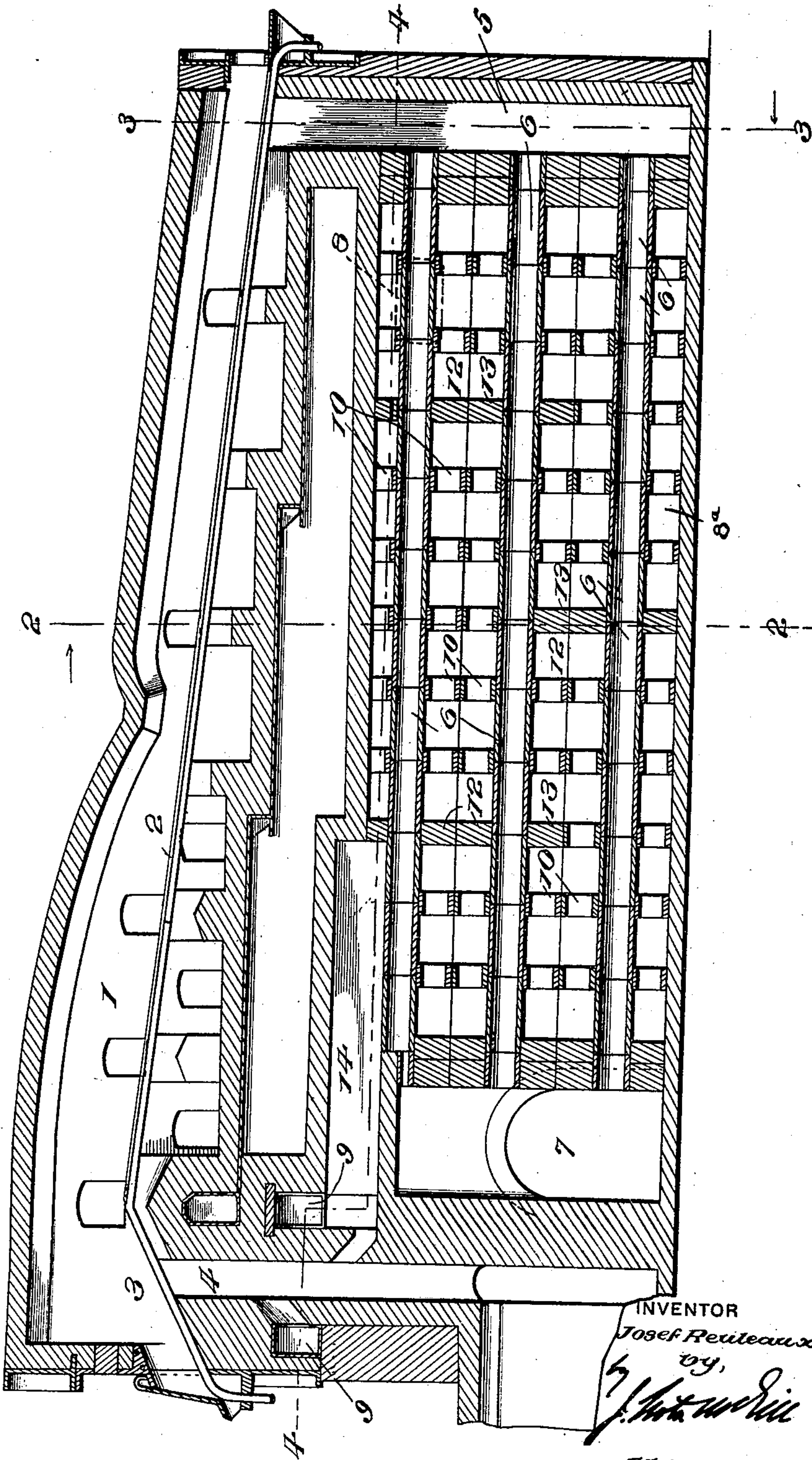
AIR HEATING APPARATUS FOR REVERBERATORY FURNACES.

APPLICATION FILED MAY 29, 1903.

NO MODEL.

3 SHEETS—SHEET 1

Fig. 1.



WITNESSES

*For Invention*  
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INVENTOR

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by,

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3 SHEETS—SHEET 2.

Fig. 5.

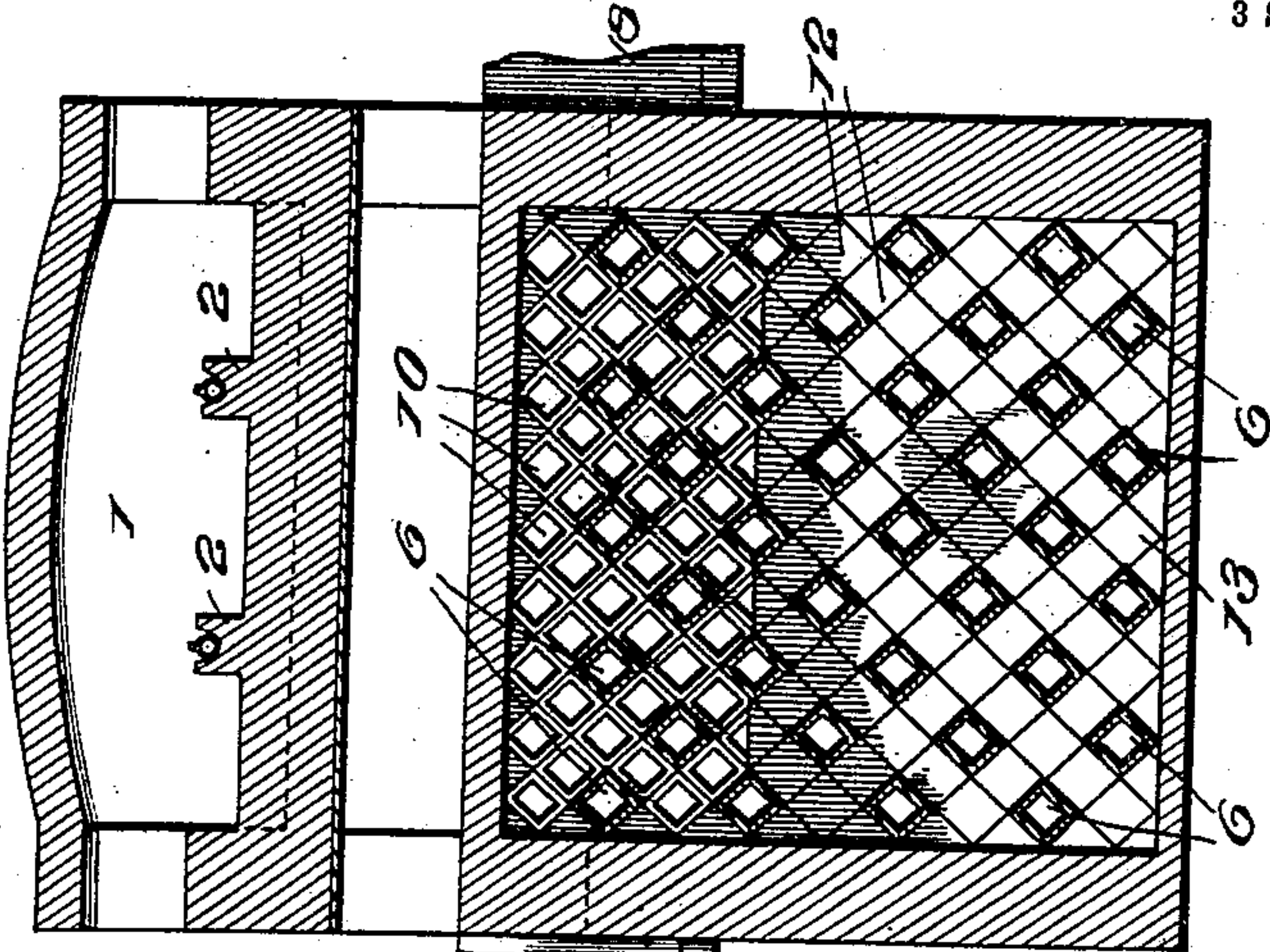


Fig. 3.

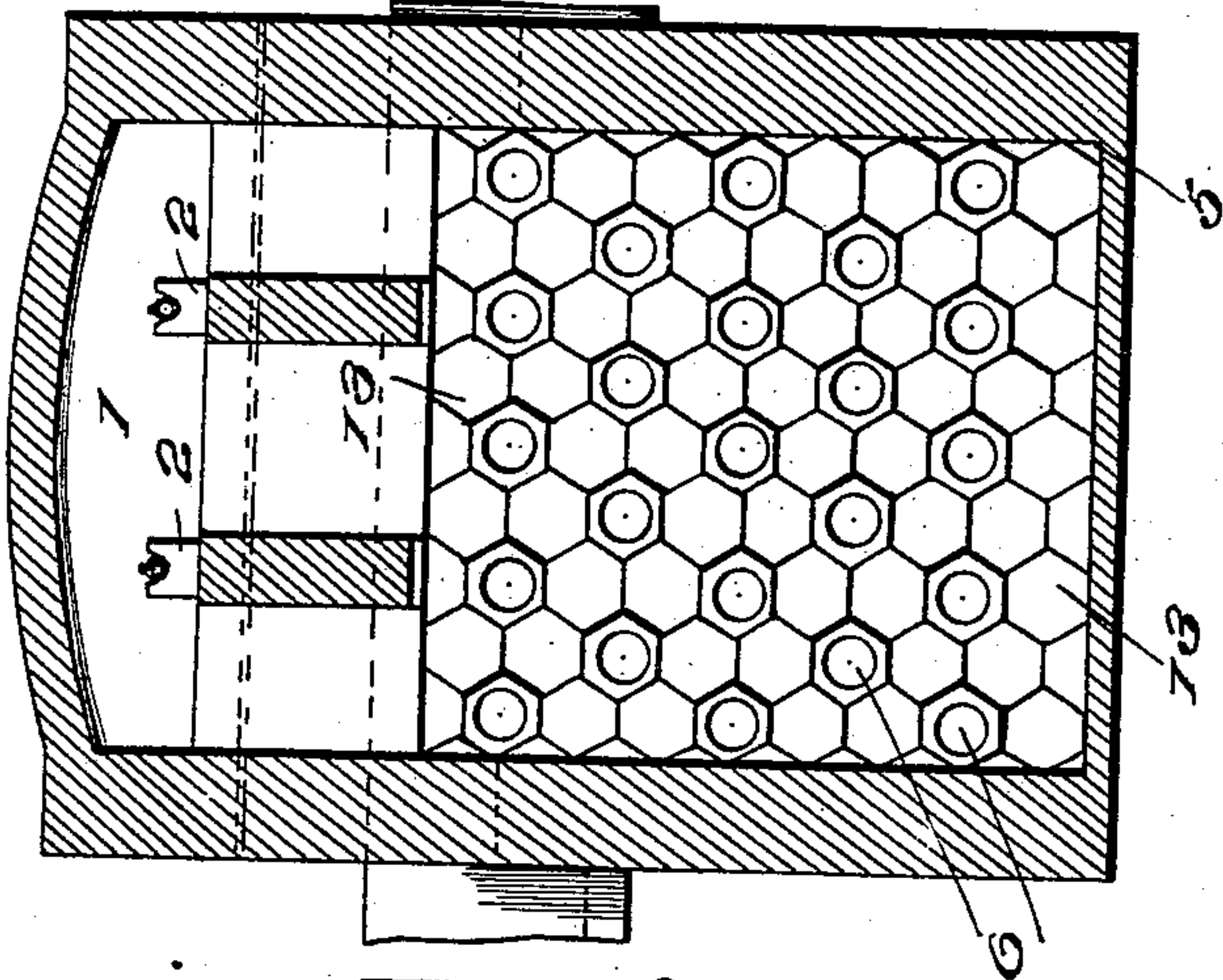
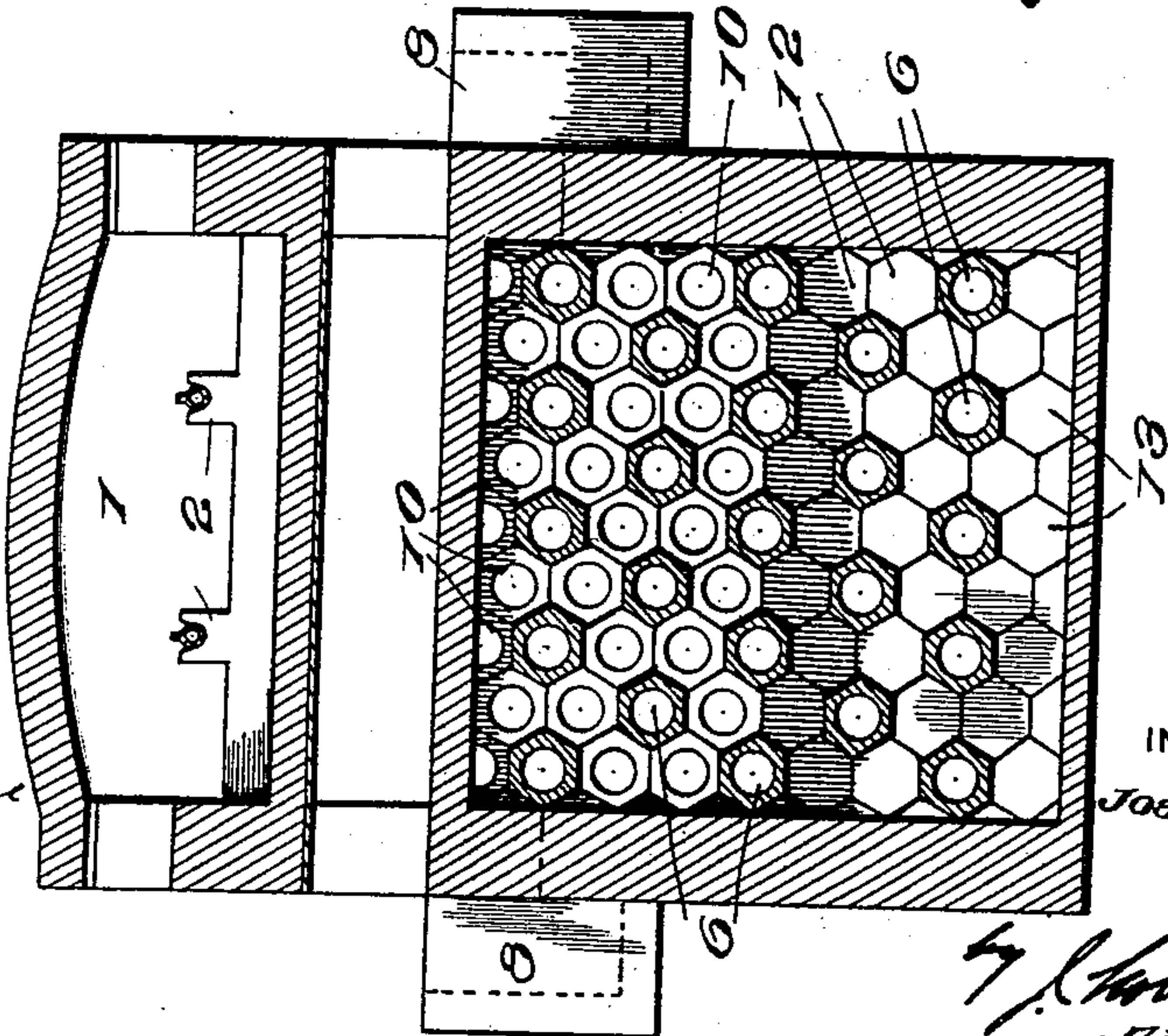


Fig. 2.



WITNESSES

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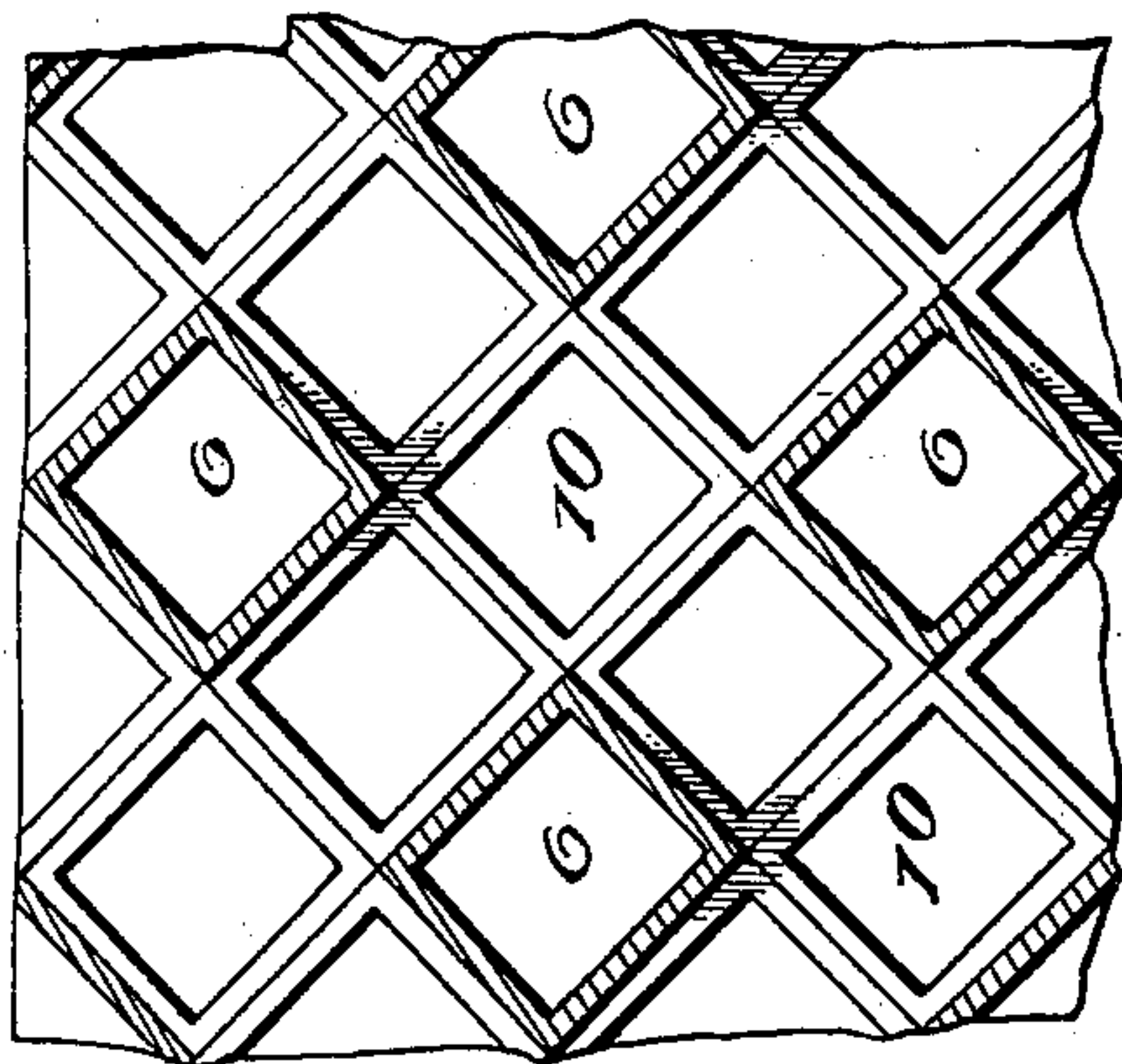
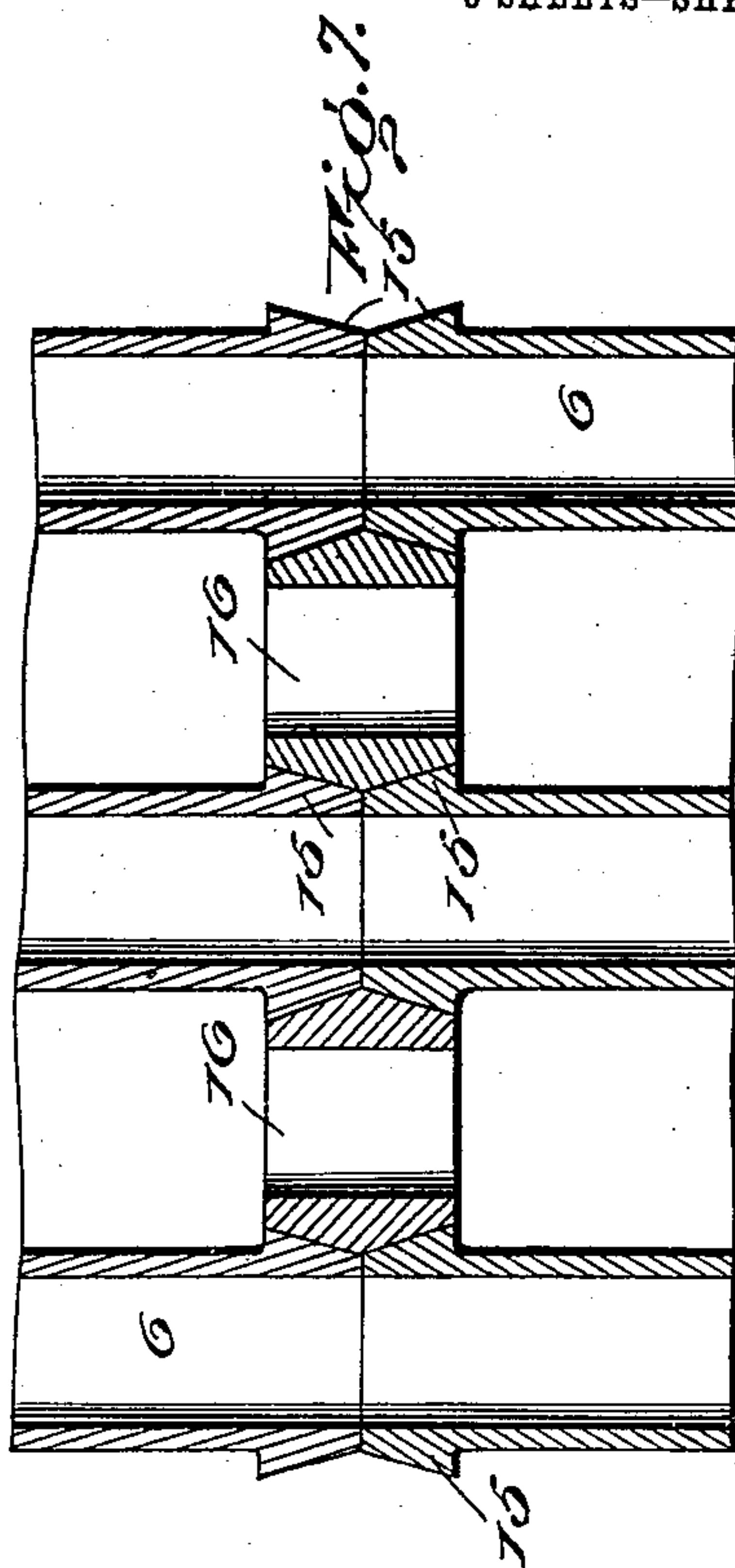
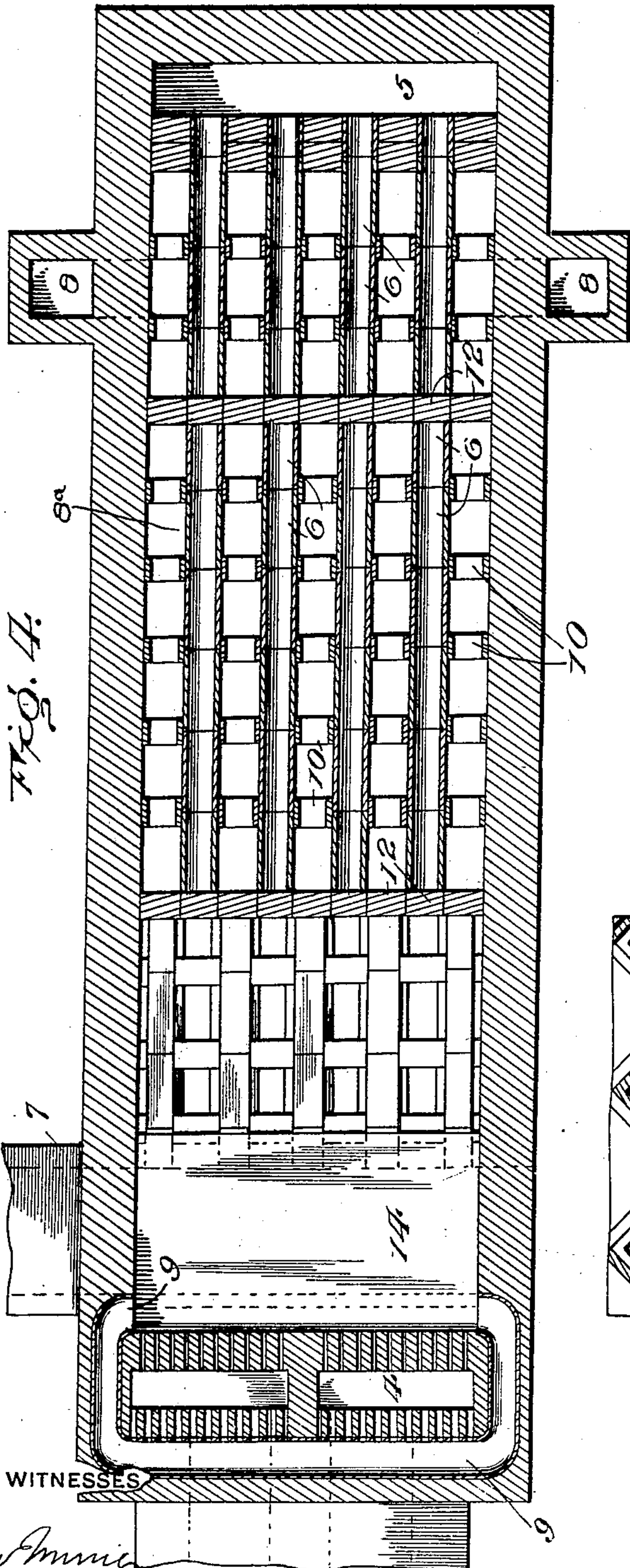
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AIR HEATING APPARATUS FOR REVERBERATORY FURNACES.

APPLICATION FILED MAY 29, 1903.

NO MODEL.

3 SHEETS—SHEET 3.



WITNESSES

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# UNITED STATES PATENT OFFICE.

JOSEF REULEAUX, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO  
ALEXANDER LAUGHLIN, OF SEWICKLEY, PENNSYLVANIA.

## AIR-HEATING APPARATUS FOR REVERBERATORY FURNACES.

SPECIFICATION forming part of Letters Patent No. 742,740, dated October 27, 1903.

Application filed May 29, 1903. Serial No. 159,334. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEF REULEAUX, of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Air-Heating Apparatus for Reverberatory Furnaces; and I 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.

The primary object of this invention is to insure the thorough preheating of air by the waste gases of a reverberatory furnace by securing the greatest possible contact between the air and the surfaces heated by such waste gases.

A further object is to so form the conduits through which the gas and air pass that they may be readily built up upon themselves without necessitating the employment of headers or independent supports.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal sectional view of a continuous heating-furnace equipped with my improvements. Fig. 2 is a cross-section on line 2 2, Fig. 1. Fig. 3 is a similar view on line 3 3, Fig. 1. Fig. 4 is a horizontal sectional view on line 4 4, Fig. 1. Fig. 5 is a view similar to Fig. 3, but illustrating a slight modification. Fig. 6 shows the same arrangement on a larger scale. Fig. 7 shows a second modification with conduits set upright.

In the drawings I have shown my improvement as applied to a continuous heating-furnace of the type embraced by Reissued Letters Patent of the United States No. 11,666, dated May 31, 1898, to Alexander Laughlin and myself. It is to be understood, however, that the invention is not restricted to employment in connection with any particular type of furnace, since it is applicable to any form wherein it is desirable or necessary to preheat the air that is to commingle with gas before entering the combustion-chamber.

In the form shown, 1 designates the combustion-chamber; 2, the longitudinally-extended supports, having the automatic dis-

charge portion 3 extended over the gas-ports 4. The waste gases or products of combustion upon reaching the far or receiving end of the furnace pass downwardly into a chamber 5, extending the full width of the furnace, and thence through conduits 6 to the other or discharge end of the furnace, where access is had to the stack or outlet-flue 7. It is in the travel of the waste gases from this chamber 5 to the stack that the air which is drawn in through side ports 8 into chamber 8<sup>a</sup> is heated before it reaches the ports 9 for intermingling with the gas entering the combustion-chamber through ports 4. It is in these conduits 6 and the arrangement for insuring the heating of the air thereby that my invention primarily resides. These conduits are preferably made from refractory material; but any other suitable material may be employed. Each conduit is composed of a series of short sections set end to end, so as to form a continuous and uninterrupted passage-way for the waste gases. In cross-section each of these conduit-sections is preferably hexagonal, as shown in Figs. 2 and 3; but their outer contours may be of any other polygonal formation. In Fig. 5 I have shown these sections as being square in cross-section, and the same arrangement is indicated on a slightly-larger scale in Fig. 6. The points of conjunction between the several sections making up a conduit are surrounded by a series of walls made up of smaller or shorter sections 10 of like material and of corresponding shape in cross-section. These shorter sections must not only serve to retain the sections of the gas-conduits in place to preserve their continuity, but also allow of the uninterrupted passage of the air. For this reason they are made hollow, following the exact formation of the longer sections composing the gas-conduits. Their flat surfaces fit snug against the flat surfaces of the longer sections, which they surround, or against the flat surfaces of other short sections, presenting, so to speak, a hollow wall or header acting as a support for the gas-conduits at the same time allowing for the free passage of the air. In this way the air is brought into direct contact with the gas-conduits at every point save at the joints between the sections,



and there is removed only by the thickness of the walls of the short sections. The several walls or headers extend from the bottom to the top and from side to side of chamber 8<sup>a</sup>.

5 To deflect the air in a zigzag manner in its travel through chamber 8<sup>a</sup>, I form solid walls 12, extending alternately downwardly from the top and upwardly from the bottom of such chamber and arranged suitable distances  
10 apart, thereby forcing the air into contact with all the gas-conduits. These walls are made up of a series of solid short sections 13 of the same exterior contour as the sections 10 and the conduit-sections 5, and being preferably arranged at the joints between the  
15 longer or conduit sections take the place of an equal number of hollow short sections. The air by the time it travels its course is thoroughly heated and after passing through  
20 the last series of joint-sections 10 rises from between the gas-conduits into an upper chamber 14, extending over the space between two or more of said walls. From there it passes into the ports 9, which surround the gas-ports  
25 4, and entering such ports thoroughly intermingles with the gas before the latter enters the combustion-chamber. Thus it will be seen that the greatest possible amount of direct contact between the air and the gas conduits  
30 is secured, so that the greatest possible range of heat is obtained for preheating the air in its travel from the air-inlet ports to the point of commingling with the gas preliminary to entering the combustion-chamber. By making  
35 the gas-conduits and the short air-conduits of the same exterior contour, at least at their points of contact, the entire series of conduits is self-supporting and the air is brought into substantially direct contact with the gas-con-  
40 duits at every point. The same advantage is present in the make-up of the deflector or solid walls, the only difference in the short sections composing the latter being that they are solid instead of hollow, like those through  
45 which the air is intended to pass. For many reasons the conduit-sections are of uniform formation throughout their lengths. It is only essential, however, that the uniformity of angularity be observed at the ends. In  
50 Fig. 7 I have shown the conduits set upright, with angular cone-like ends 15, the surrounding short sections or air-conduits 16 being of double truncated-cone formation.

I claim as my invention—

55 1. In a reverberatory furnace, a series of conduits through which the waste gas passes in its travel to the smoke stack or outlet, and hollow shorter sections surrounding and supporting such conduits, which latter and the  
60 shorter sections have corresponding exterior engaging surfaces, as set forth.

2. In a reverberatory furnace, a series of conduits through which the waste gas passes in its travel to the smoke stack or outlet, such  
65 conduits being made up of short sections arranged end to end, and a series of shorter sections surrounding the former sections at

their meeting joints, the second series being of the same peripheral contour as the first series, as set forth.

3. In a reverberatory furnace, a series of conduits through which the waste gas passes in its travel to the smoke stack or outlet, such conduits being made up of short sections, arranged end to end, and a series of shorter sections surrounding the former sections at  
70 their meeting joints, such shorter sections being of the same peripheral contour as the said conduit-sections, both series of sections being of polygonal formation in cross-section, as and  
75 for the purpose set forth.

4. The arrangement of gas and air conduits herein described, comprising a series of gas-conduits made up of sections arranged end to end, and a series of walls composed of a second series of shorter sections built up around  
80 the former sections at the joints thereof and of the same peripheral contour as said conduit-sections, all the sections being of polygonal formation in cross-section, as set forth.

5. The arrangement of gas and air conduits herein described comprising a series of spaced-apart gas-conduits made up each of a series of sections arranged end to end and of polygonal formation in cross-section, a second series of shorter conduit-sections surrounding  
85 the several gas-conduits at the joints of the sections thereof, and forming air-conduits paralleling the gas-conduits, such shorter sections being of polygonal formation in cross-section corresponding to the formation of the  
90 gas-conduit sections, as set forth.

6. The combination with a reverberatory furnace having at one end a smoke-stack and at the other end a chamber for the waste gas, and side air-inlets, of a series of gas-conduits forming communication between said chamber and stack, said conduits being of polygonal formation in cross-section, and a series of spaced-apart headers composed of short  
95 hollow sections surrounding said gas-conduits and also of polygonal formation in cross-section corresponding to the formation of the gas-conduits, the air being free to pass through said short sections, as set forth.

7. The combination with a reverberatory furnace having at one end a smoke-stack and at the other end a chamber for the waste gas, and side air-inlets, of a series of spaced-apart gas-conduits forming communication between  
100 said chamber and stack, said conduits being of polygonal formation in cross-section, and a series of spaced-apart deflector-walls intermediate said air-inlets and the stack, said walls being made up of a series of hollow and solid  
105 sections of polygonal formation in cross-section corresponding to the formation of the gas-conduits, as set forth.

8. The combination with a reverberatory furnace having at one end a smoke-stack and at the other end a chamber for the waste gas, and side air-inlets, of a series of gas-conduits forming communication between said chamber and stack, such conduits being composed  
110



of short sections set end to end and of polygonal formation in cross-section, a series of walls intermediate the air-inlets and the stack, such walls being made up of short sections surrounding the gas-conduit sections at the joints thereof, and of the same polygonal formation as the latter, such short sections being hollow for the passage of air therethrough, and an air-chamber into which the heated air is discharged before entering the furnace, as set forth.

9. The combination with a reverberatory furnace having at one end a smoke-stack and at the other end a chamber for the waste gas, and side air-inlets, of a series of gas-conduits forming communication between said chamber and stack, such conduits being composed of short sections set end to end and of polygonal formation in cross-section, a series of walls intermediate the air-inlets and the stack, such walls being made up of short sections surrounding the gas-conduit sections at the joints thereof, and of the same polygonal formation as the latter, some of the short sections of certain walls thereof being solid while the others of such short sections are hollow for the passage of air therethrough, and an air-chamber into which the heated air is discharged before entering the furnace, as set forth.

10. The combination with a reverberatory furnace having at one end a smoke-stack and at the other end a chamber for the waste gases, and an air-chamber intermediate said latter chamber and smoke-stack, of a series of

spaced-apart gas-conduits extending through said air-chamber and forming communication between said waste-gas chamber and the stack, a series of spaced-apart walls extending from the bottom to top of said air-chamber, and having each a series of hollow sections for the passage of air therethrough, and an air-chamber extending over the spaces between some of the walls and into which the air enters from such spaces, as set forth.

11. The combination with a reverberatory furnace having at one end a smoke-stack and at the other end a chamber for the waste gases, and an air-chamber intermediate said latter chamber and smoke-stack, of a series of spaced-apart gas-conduits extending through said air-chamber forming communication between said waste-gas chamber and the stack, said conduits being of polygonal formation in cross-section, a series of spaced-apart walls extending from the bottom to top of said air-chamber and having each a series of hollow sections for the passage of air, such latter sections being of the same polygonal formation as the gas-conduits, and an air-chamber extending over the spaces between some of said walls and into which the air enters from such spaces, as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOSEF REULEAUX.

Witnesses:

THOMAS DURANT,  
FRANCIS S. MAGUIRE.