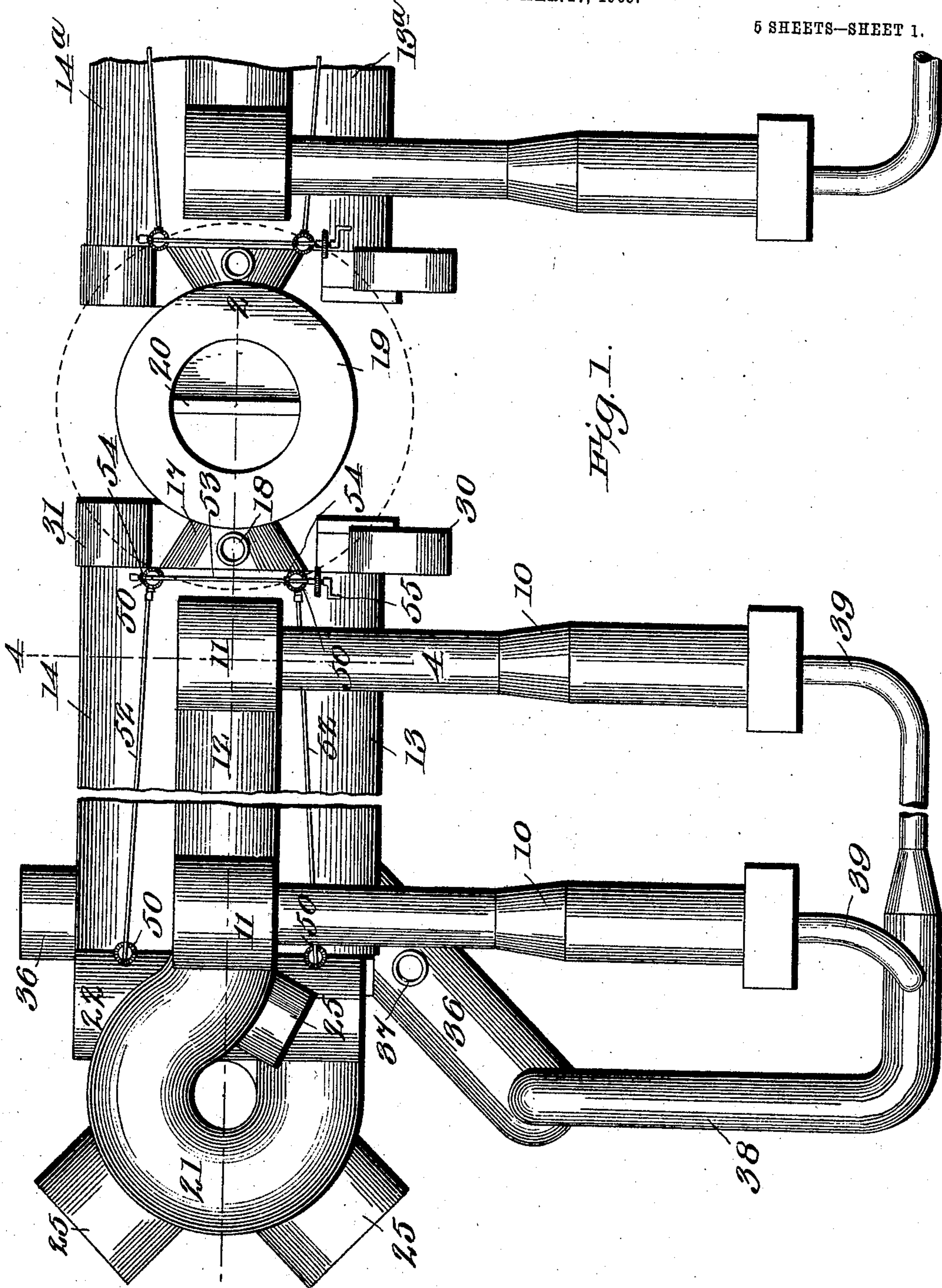


No. 805,953.

PATENTED NOV. 28, 1905.

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CEMENT BURNING KILN.  
APPLICATION FILED MAR. 27, 1905.

5 SHEETS—SHEET 1.



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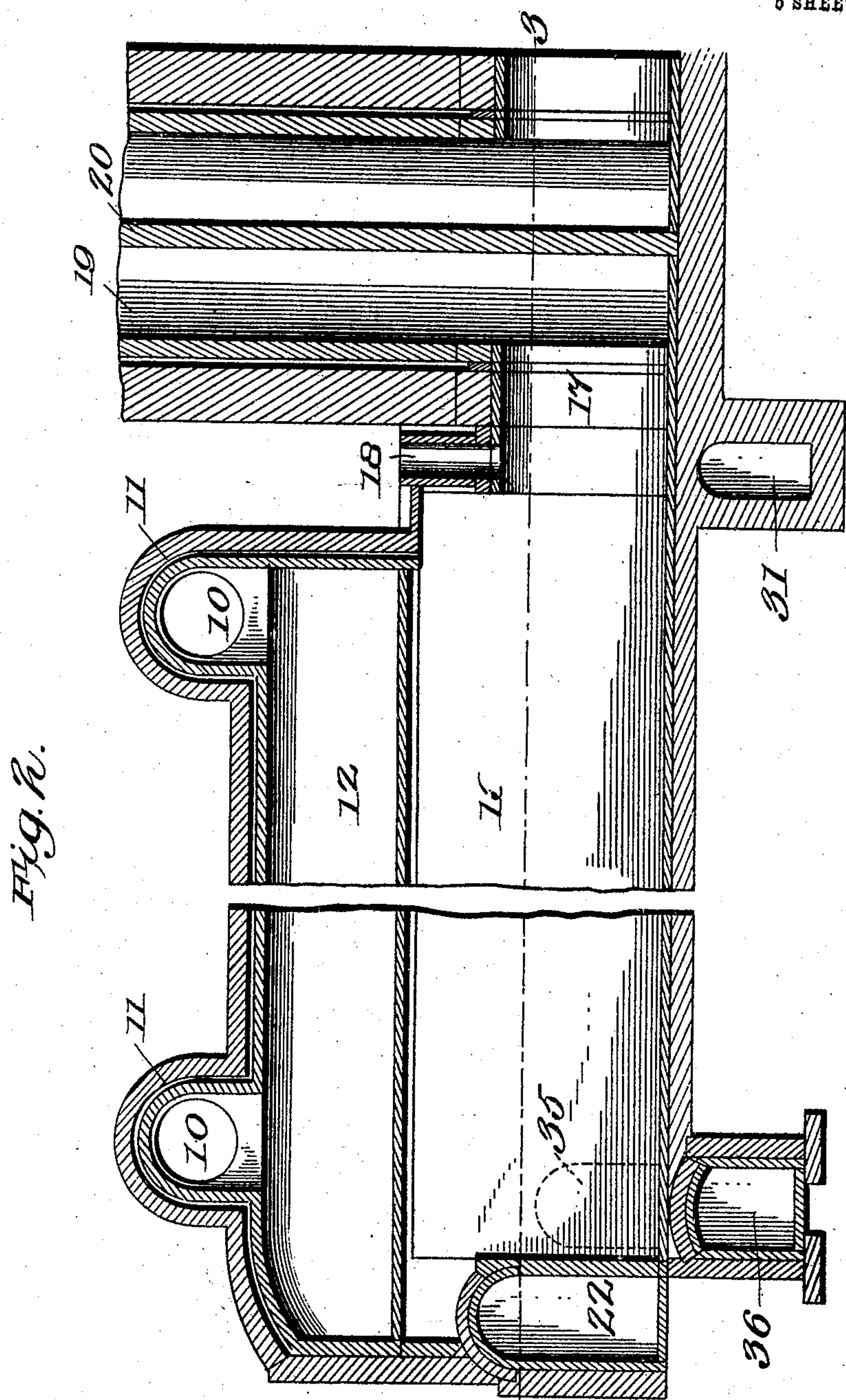
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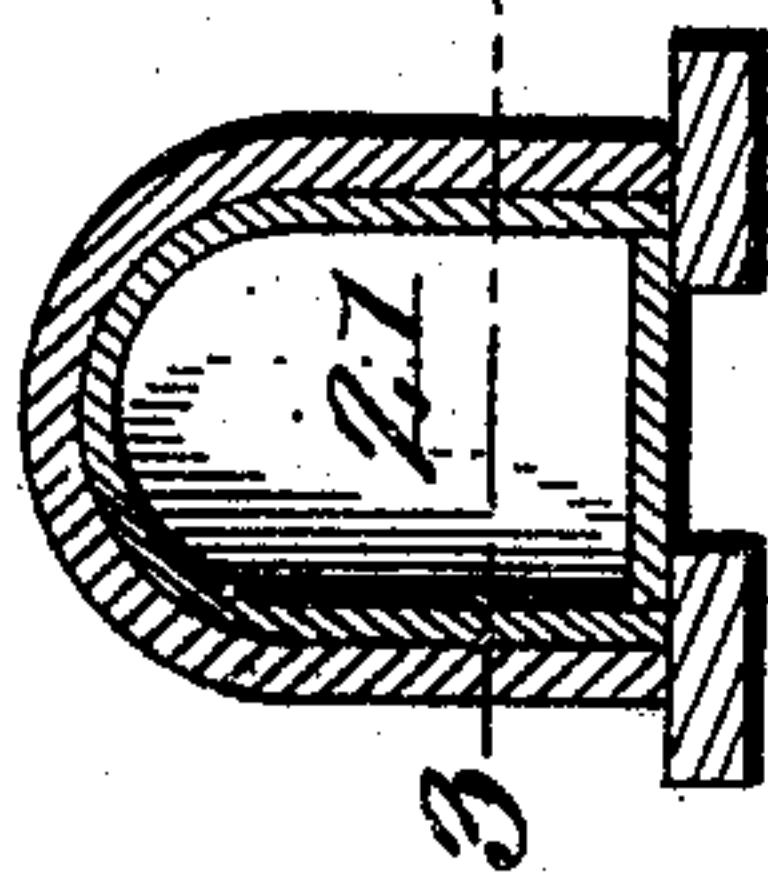
APPLICATION FILED MAR. 27, 1905.

5 SHEETS—SHEET 2.



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6 SHEETS—SHEET 3.

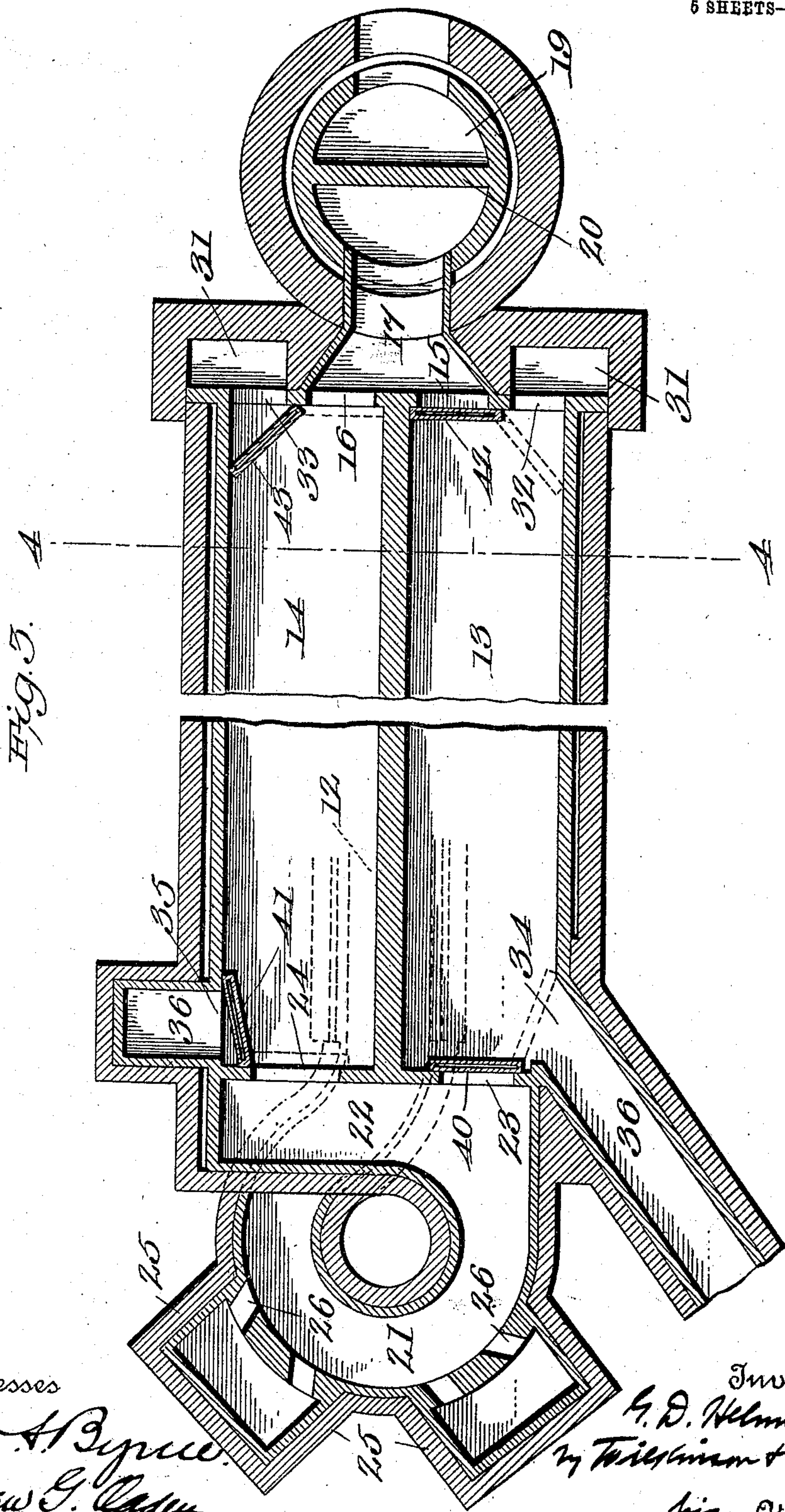


Fig. 3. A

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5 SHEETS—SHEET 4.

Fig. 4.

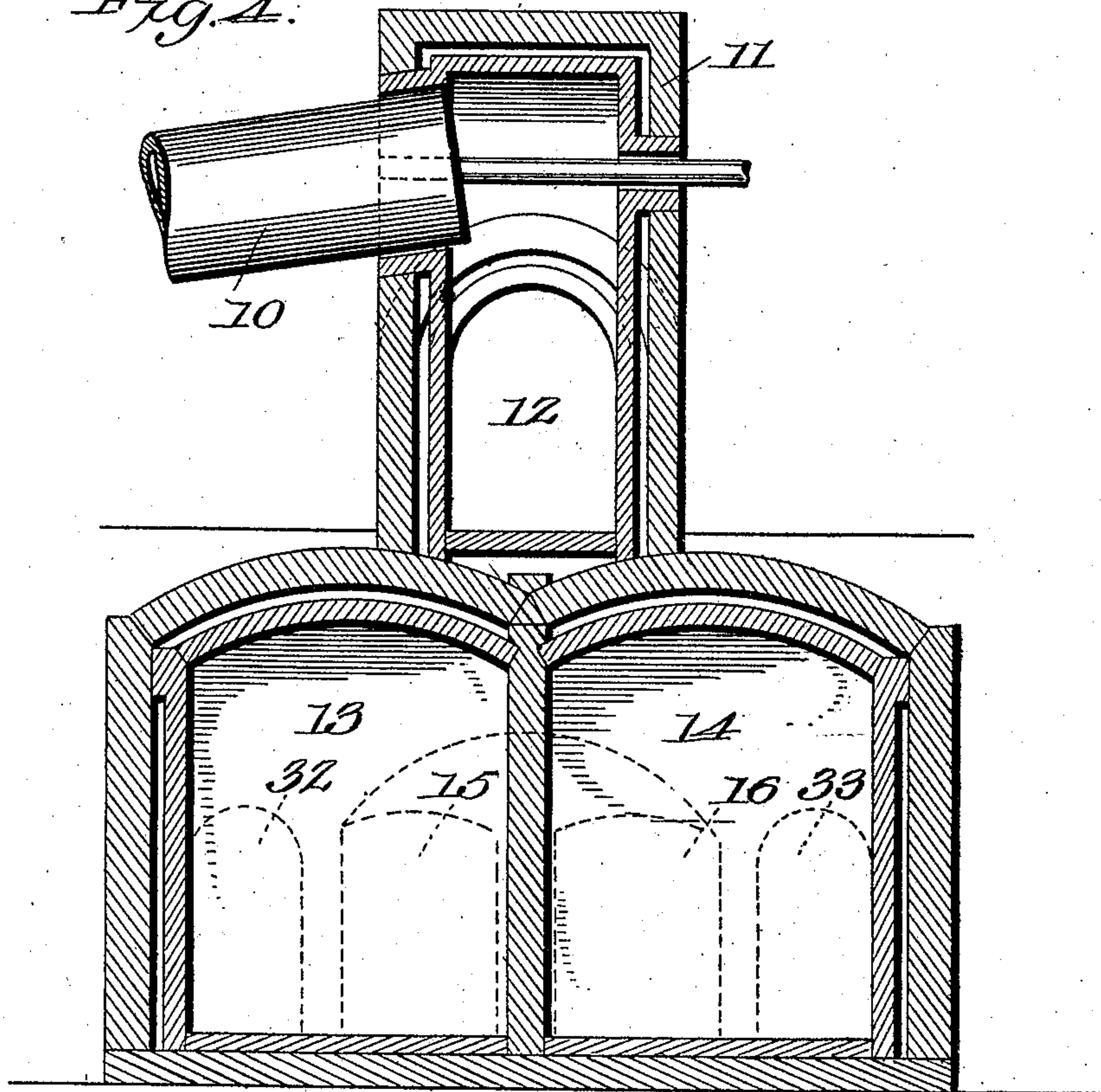


Fig. 5.

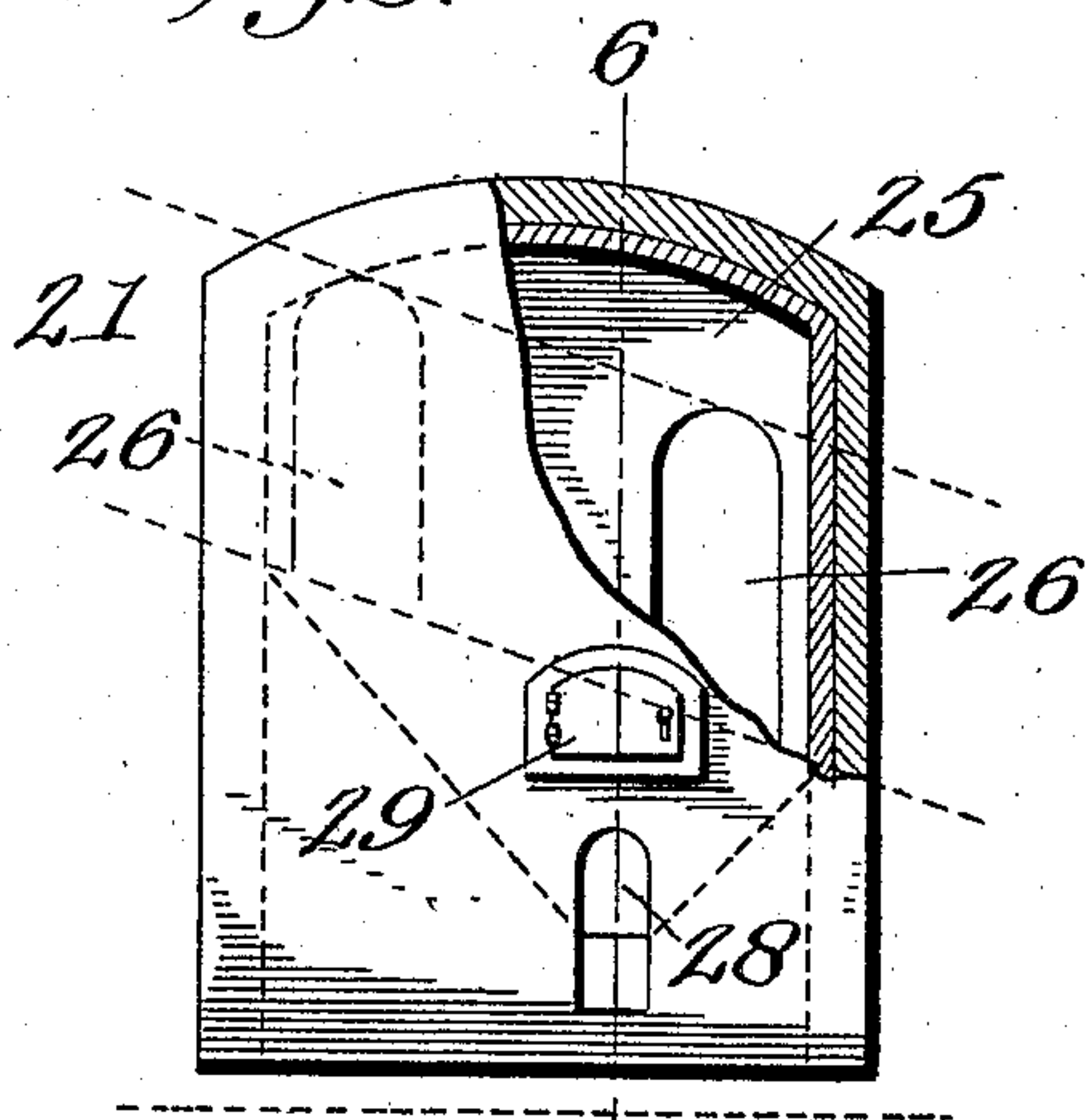
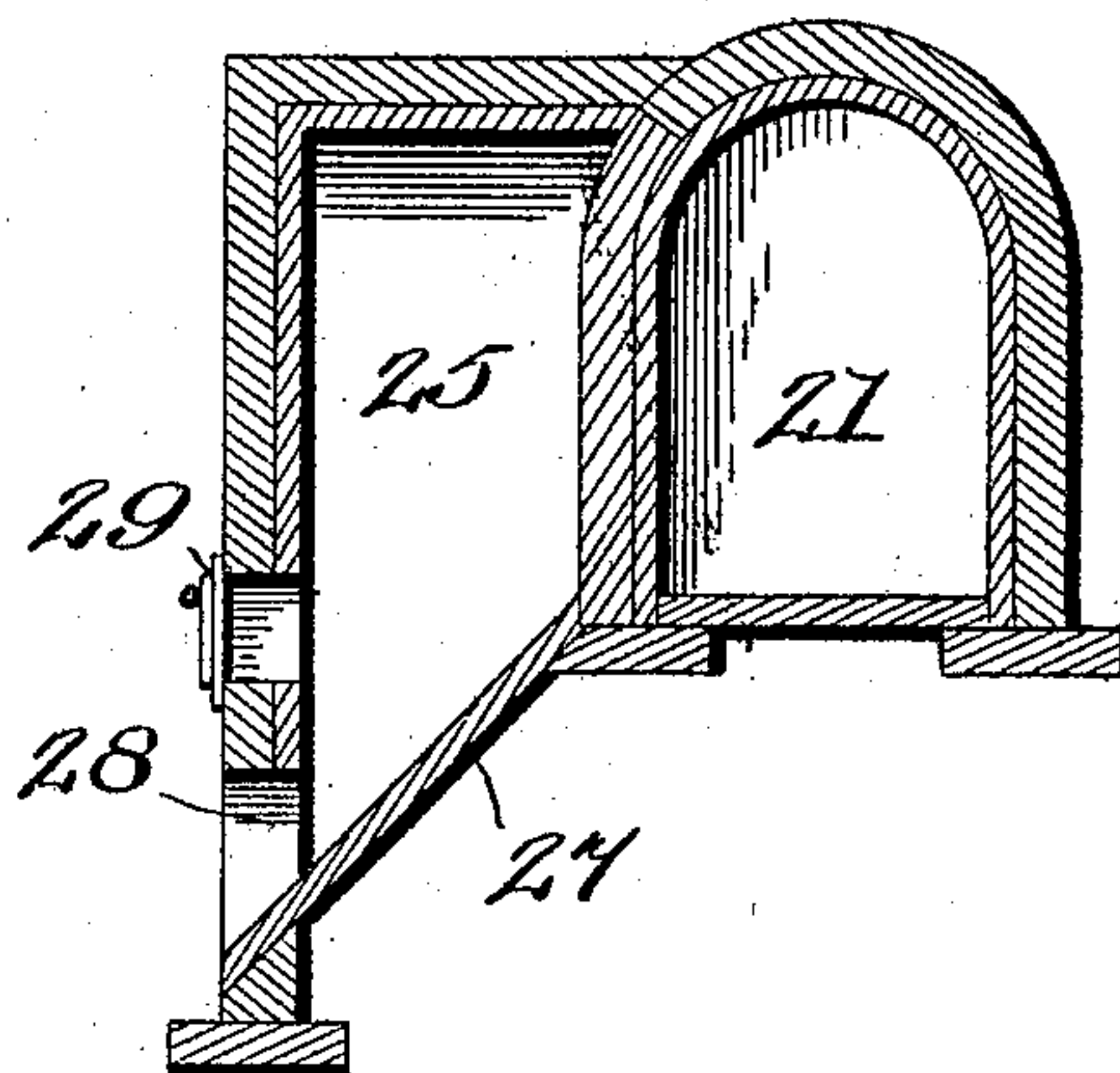


Fig. 6.



Witnesses

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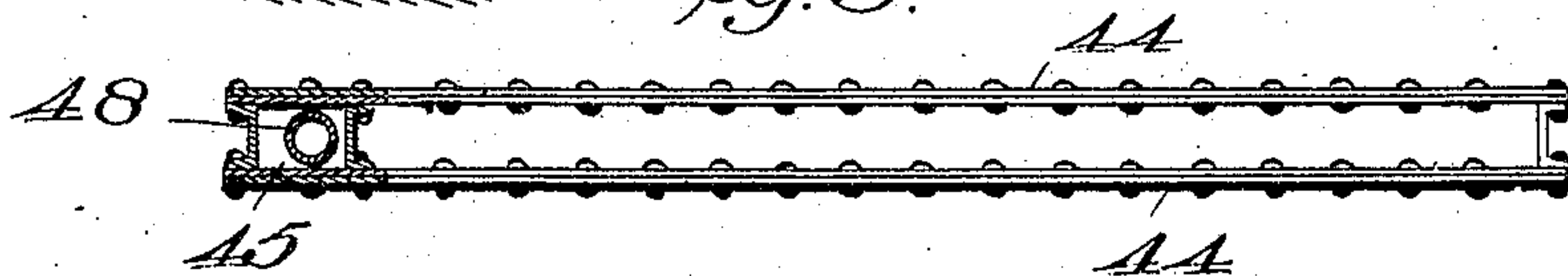
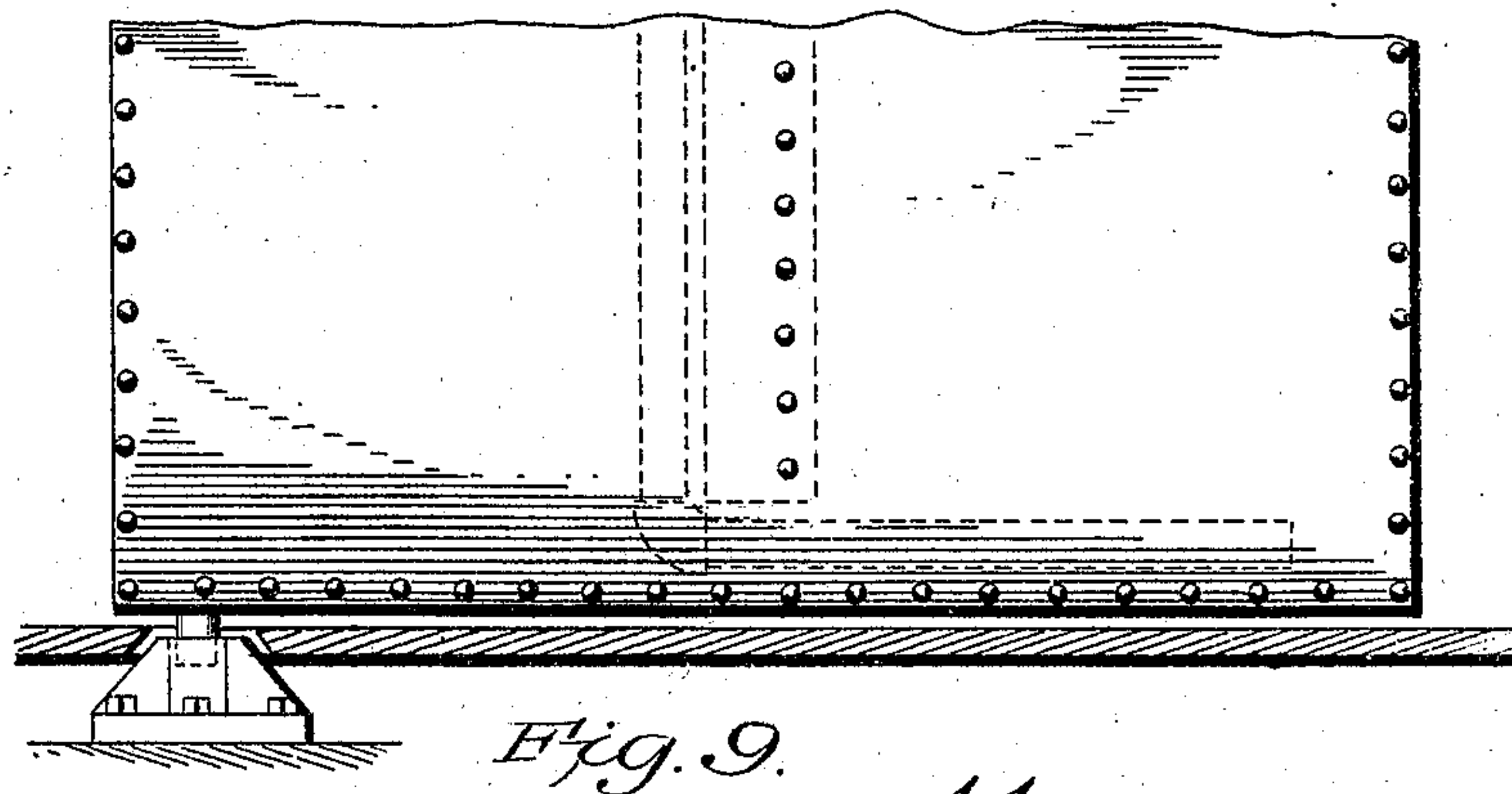
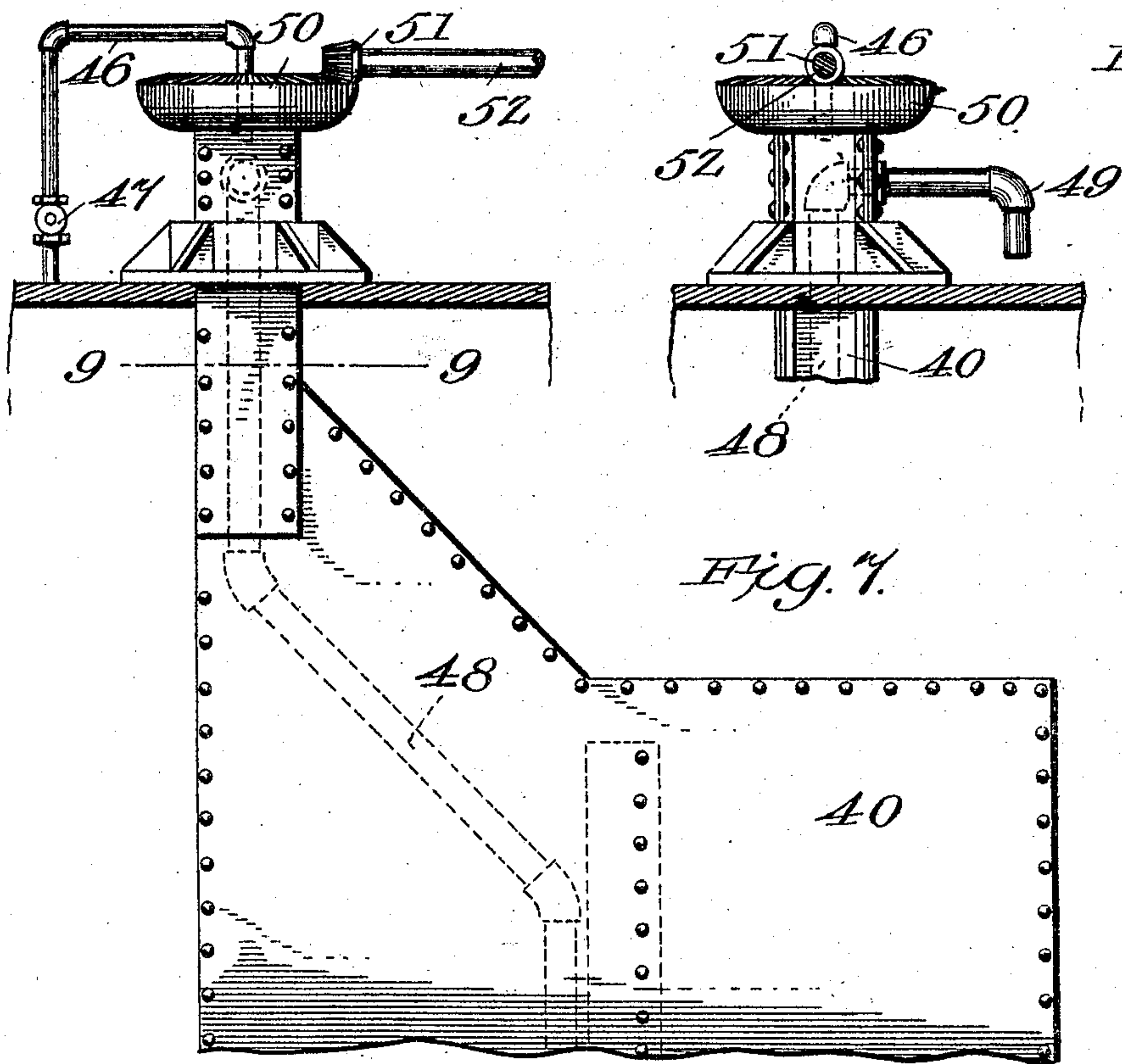
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5 SHEETS—SHEET 5.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

GUY D. HELMICK, OF FORT RUSSELL, WYOMING.

## CEMENT-BURNING KILN.

No. 805,953.

Specification of Letters Patent.

Patented Nov. 28, 1905.

Application filed March 27, 1905. Serial No. 252,295.

*To all whom it may concern:*

Be it known that I, GUY D. HELMICK, a citizen of the United States, residing at Fort Russell, in the county of Laramie and State of Wyoming, have invented certain new and useful Improvements in Cement-Burning Kilns; 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.

This invention relates to cement-burning kilns, and is designed as an improvement over the earlier and more common means of calcining Portland-cement clinker with the use of a rotary furnace which, although economical of labor, is wasteful of fuel, largely due to the excess of cold air introduced into the furnace to support combustion and the high temperature of the waste gases discharged up the stack. The main supply of heat used in the process of calcination is commonly derived from the combustion of gas, oil, or powdered coal at the mouth of the furnace, the heated gases therefrom passing over the cement-clinker and still retaining about fifty per cent. of their heat units when passing from the furnace.

The object of the invention is to provide improved means adapted to utilize this immense amount of otherwise lost heat, preferably through the use of a battery of regenerative furnaces suitably connected to the kiln, which are alternately heated by the waste products of combustion and are used in turn when so heated to heat the air introduced into the mouth of the furnace to support combustion, suitable means being provided in the line of travel of the gases to thoroughly clean them before the regenerative apparatus is reached.

To the accomplishment of this object and such others as may hereinafter appear, the invention comprises the novel construction hereinafter described, and pointed out in the claims, reference being had to the accompanying drawings, showing the preferred embodiment thereof, in which the same reference characters designate like parts throughout the several views, and in which—

Figure 1 is a plan view of the kiln, showing how a number of rotary furnaces may be used and on both sides of the stack. Fig. 2 is a sectional elevational view on line 2 2 of Fig. 1. Fig. 3 is a sectional plan view on line 3 3 of Fig. 2. Fig. 4 is a sectional elevational view on line 4 4 of Fig. 1. Fig. 5 is an elevational view

of one of the dust-chambers, partly broken away. Fig. 6 is a sectional elevational view on line 6 6 of Fig. 5. Fig. 7 is a front elevational view of one of the damper-doors. Fig. 8 is a detail side view of the upper bearing of one of the damper-doors; and Fig. 9 is a plan view of Fig. 7, taken on line 9 9 thereof.

Referring to the drawings, 10 represents rotary furnaces of any suitable type arranged to revolve on roller-bearings, as is common, and set at a slight incline, so that materials introduced into the upper end are gradually carried to and discharged at the lower end by the rotation of the furnace. The upper ends of these furnaces 10 are each surrounded by a flue or chamber 11, which are in turn interconnected by a main flue 12, which runs transversely beneath the ends of the rotary furnaces. This flue 12 is preferably located centrally above the upper floors of a pair of chambers or flues 13 and 14, which are formed into regenerative furnaces by filling them with the usual checker-work of fire-brick. (Not shown.) The regenerative furnaces 13 and 14 are connected through suitable openings 15 and 16, respectively, with a passage-way 17, provided with a manhole 18, which opens into a stack 19, which preferably is provided with a centrally-arranged vertical partition 20, so that similar regenerative furnaces 13<sup>a</sup> and 14<sup>a</sup> may be connected up in a similar manner, as described, to the other side thereof.

A suitable connection between flue 12 and the regenerative furnaces 13 and 14 is constructed as follows: The end of flue 12 after passing the rotary furnace 10 farthest from stack 19 assumes a downwardly-directed spiral form 21 and connects with a chamber 22, extending transversely across the ends of regenerative furnaces 13 and 14. Suitable openings 23 and 24 are provided between transverse chamber 22 and these furnaces. At suitable intervals along the outer periphery of spiral chamber 21 are located dust-chambers 25, connected with the spiral by means of narrow slits 26, formed in the wall thereof. These dust-chambers are provided with slanting floors 27, which lead into openings 28 in the outer walls thereof, at which point any suitable means, as bucket elevators, for collecting and removing the dust may be located. The outer walls of these dust-chambers are also provided with doors 29 for the purpose of inspection.

In any suitable position, preferably at the end of the apparatus adjacent stack 19, is lo-



cated any suitable means, as a rotary fan 30, of suitable power for forcing air into a flue 31, which is connected to regenerative furnaces 13 and 14 through openings 32 and 33, respectively. The opposite ends of furnaces 13 and 14 are also provided with openings 34 and 35, respectively, which lead into a flue 36, provided with a manhole 37, which flue in turn leads into a pipe 38, provided with branches 39, extending into the forward end of each of the furnaces 10.

A damper-door 40 is mounted between openings 23 and 34 in one end of regenerative furnace 13, so that when it closes one of said openings the other will always be open. Doors 41, 42, and 43 are similarly situated between openings 24 35, 15 32, and 16 33, respectively. As these doors are subject to a very great heat, they are preferably water-cooled, and to this end are made hollow by constructing them of a pair of plates 44, suitably connected by channels or other sections, whereby a box-like structure is formed, into which water may be continuously run through an opening 45 in the top from a water-pipe 46, leading to any source of supply controlled by a valve 47. In the interior of the doors is located an overflow-pipe 48, which projects from one side of the bearing above the level of the upper floor of the regenerative chambers, as shown at 49.

It is essential that when openings 33 and 35, leading from the regenerative furnace 14, are closed by their doors 43 and 41, respectively, openings 15 and 23, leading from regenerative furnace 13, should be closed by their doors 42 and 40, respectively. It is also convenient that all these four doors should be operated at the same time, and any suitable mechanism which will accomplish this desired end may be used; but the preferred form is shown in Figs. 1 and 7, which consists of a beveled gear-wheel 50, mounted on the axis of each of the four doors, which gears are so connected with other beveled gears 51, mounted on the ends of rods 52, that when the gears on, say, doors 42 and 43 are rotated by means of shaft 53, having gears 54 thereon engaging the gears 50, all the doors will be rotated in the direction and through the angle desired. Shaft 53 may be rotated by any suitable means, those here shown being merely a hand-crank 55.

It should be understood that the apparatus connected up to the right-hand side of stack 19 in Fig. 1 is similar in all respects to that already described, and therefore a detailed description thereof is not deemed necessary.

In the operation of the furnace it will be assumed that the four damper-doors are in the position shown in Fig. 3. Now when heat is generated at the lower end of furnaces 10 and the gases are sent therethrough over the cement mixture which has been previously fed therein through the upper end by any suitable means in general use these gases are collected from all the furnaces in flue 12 and are drawn

down through spiral flue 21, which gives them a swirling motion and carries them down into chamber 22 to the level of the regenerative furnaces 13 and 14. The centrifugal force occasioned by the swirl of the gases drives the dust contained therein into the quiescent atmosphere of dust-chambers 25, where it is collected and carried off as before described. On reaching chamber 22, the opening 23 being closed by door 40, the gases pass through opening 24 and heat the checker-work of fire-brick in chamber 14, afterward passing through opening 16 and up the stack 19. When this action has been carried on for a sufficient period to thoroughly heat the bricks in chamber 14, rod 53 is rotated sufficiently to move the four damper-doors from the positions shown in full lines in Fig. 3 to those shown in dotted lines, which throws openings 33 and 35 of chamber 14 clear and openings 15 and 23 of chamber 13 clear. The flow of the gases is therefore changed to pass through and heat the fire-brick in chamber 13 instead of in chamber 14, and while this heating operation is taking place fan 30 is set in operation, drawing cold air into flue 31, which air it forces through opening 33 and into regenerative furnace 14, in passing through which furnace the air takes up the heat from the fire-bricks, and passing out of opening 35 and into flue 36 finally finds its way into pipe 38 and through its branches 39 into the forward end of the furnace, where it is used in this heated condition to support combustion. When the fire-brick in chamber 13 have been sufficiently heated, the damper-doors are again thrown back into their former position and the cold air from fan 30 is sent through this chamber instead of through chamber 14, the operation of heating the air used to support combustion being thus kept up indefinitely through the use of the waste furnace-gases.

It is not desired to be understood that the invention is limited to the details of construction and arrangement of parts as herein described and illustrated, as it is manifest that numerous variations and modifications may be made in adapting the device to various conditions of use without departing from the spirit and scope thereof. The right is therefore reserved to all such variations and modifications as properly fall within the scope of the invention and the terms of the following claims.

I claim—

1. The combination with a burning-furnace, of a regenerator located below said furnace, a spirally-descending flue communicating between said furnace and said regenerator and provided with an aperture in its peripheral surface, a dust-collecting box adjacent said aperture, and flue connections between said regenerator and said furnace for introducing the returned heated air to the material being treated.

2. The combination with a plurality of burning-furnaces, of a plurality of regenerators



below said furnaces, a spirally-descending flue communicating between said furnaces and said regenerator and provided with apertures in its peripheral surface, dust-collecting boxes  
5 adjacent said apertures, and flue connections between said regenerator and said furnaces for introducing the returned heated air to the material being treated.

10 3. The combination with a plurality of burning-furnaces, of a plurality of regenerators, a single spiral flue connecting up all of said furnaces with said regenerators and controlling means between said spiral flue and regenerators, dust-collecting means for said spiral  
15 flue, and independent flue connections between said regenerators and furnaces.

4. The combination with a burning-furnace, of a regenerator, a spirally-descending flue communicating between said furnace and said regenerator, provided with an aperture in its  
20 periphery, a dust-collecting box adjacent said aperture, said box having a slanting floor and an exit-opening, and independent flue connections between said regenerator and said  
25 furnace arranged out of the limits of said spiral flue.

In testimony whereof I affix my signature in presence of two witnesses.

GUY D. HELMICK.

Witnesses:

GEO. A. CURRY,  
F. D. FRENCH.