

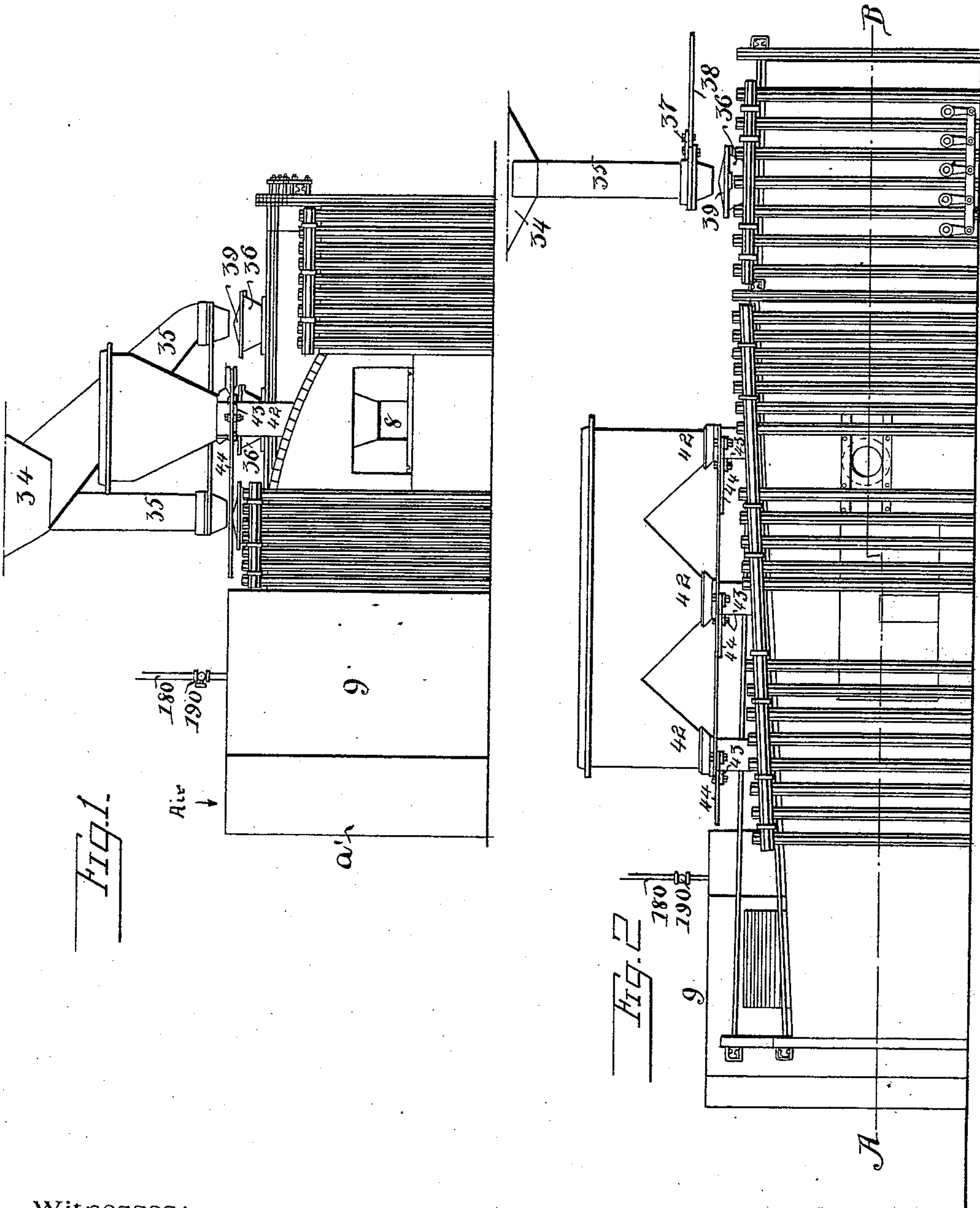
(No Model.)

8 Sheets—Sheet 1.

J. S. DOUGHERTY.
FURNACE.

No. 541,602.

Patented June 25, 1895.



Witnesses:

Jesse B. Hellett.
John T. Carr

Inventor.

J. S. Dougherty

J. G. Handberg

Attorney.

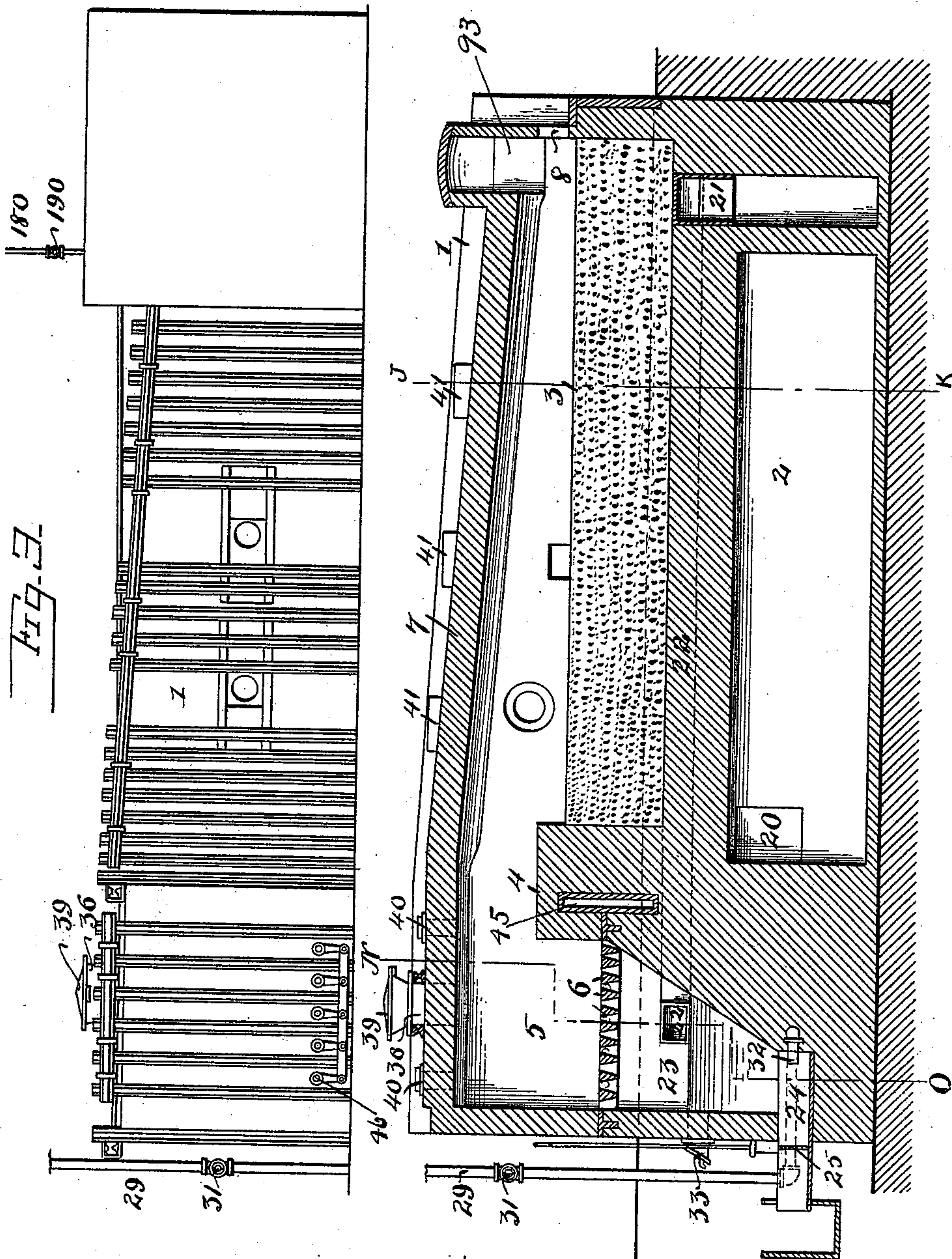
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John F. Carr

Inventor.

John S. Dougherty
Wm. G. Harding
Attorney.

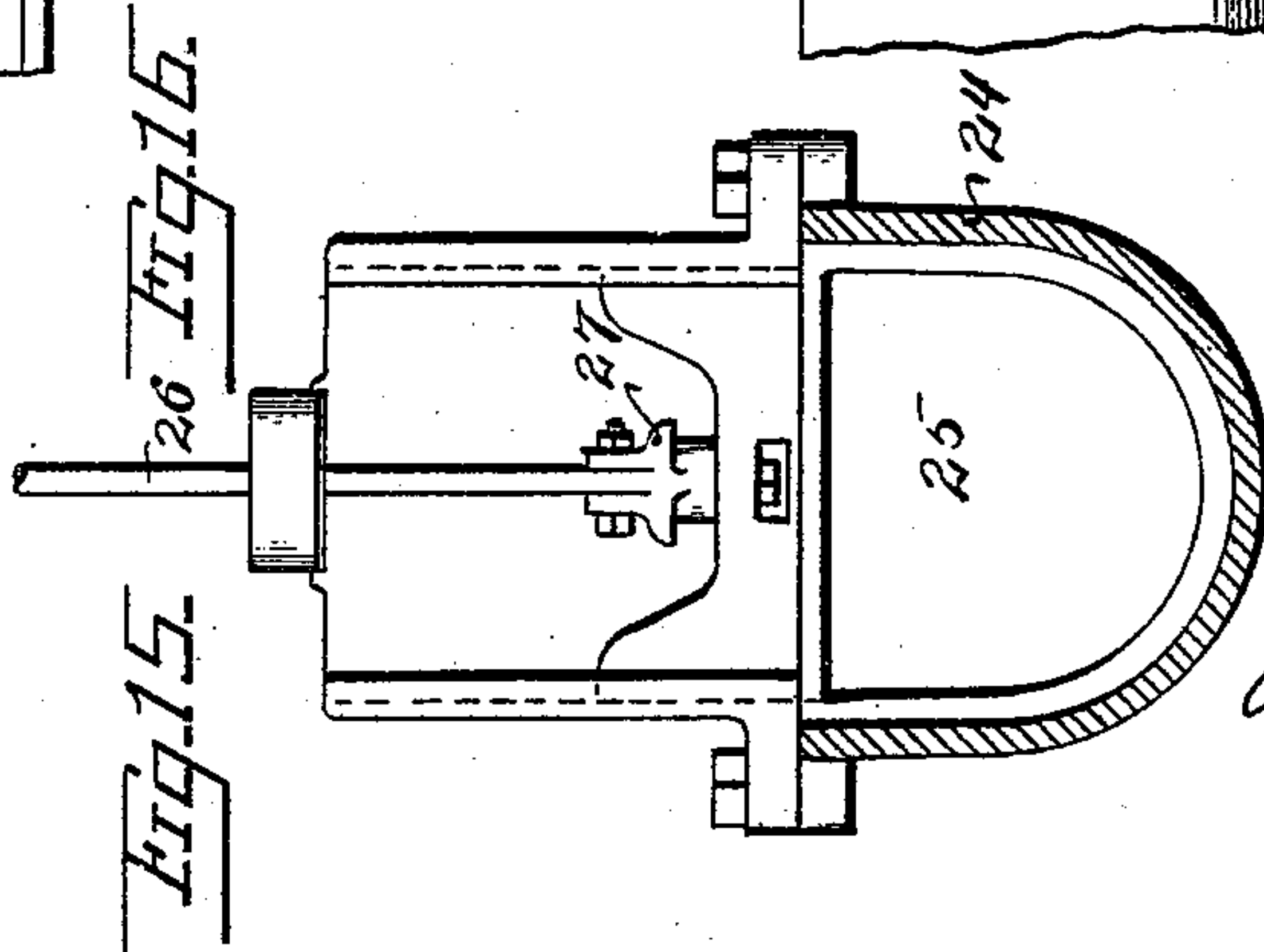
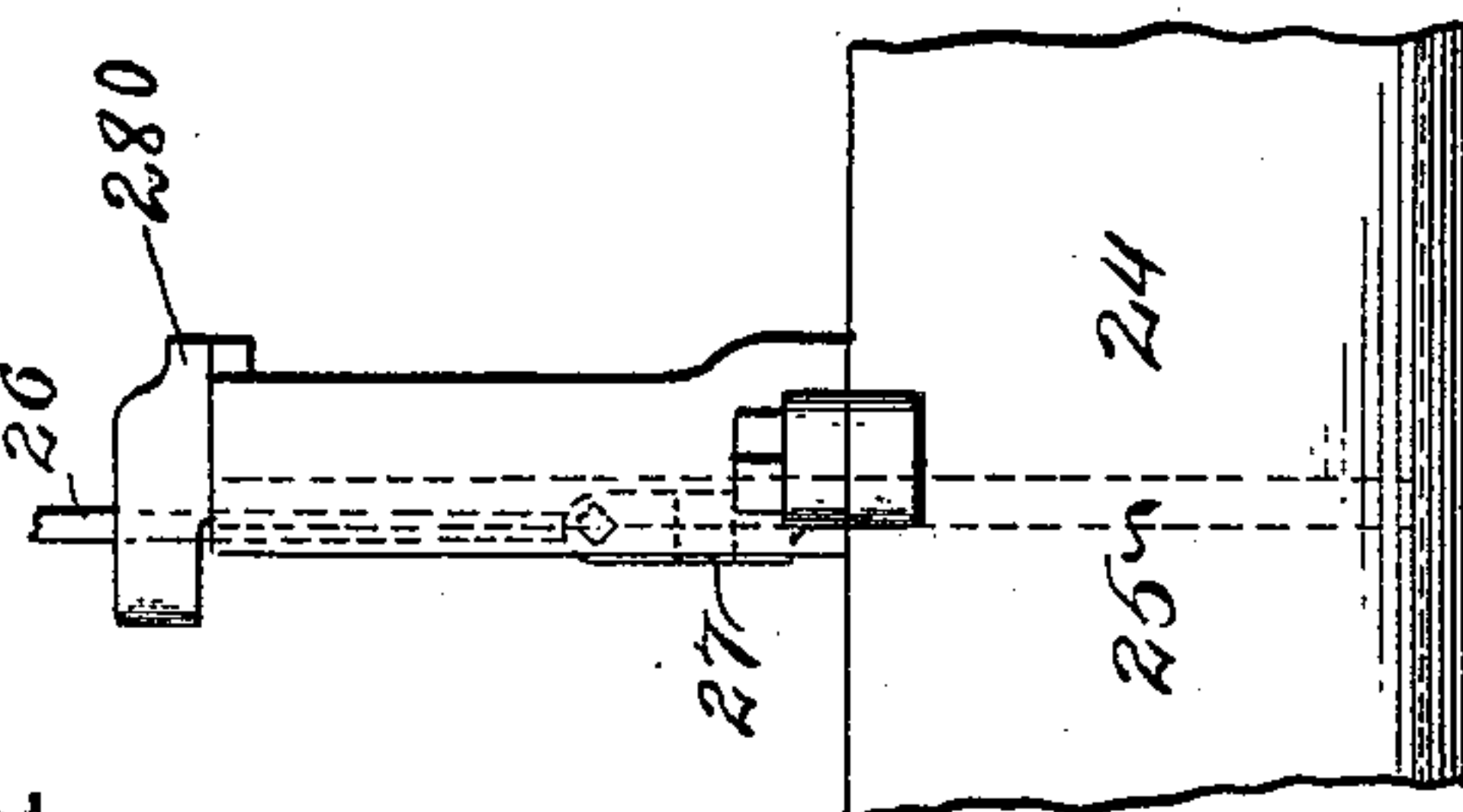
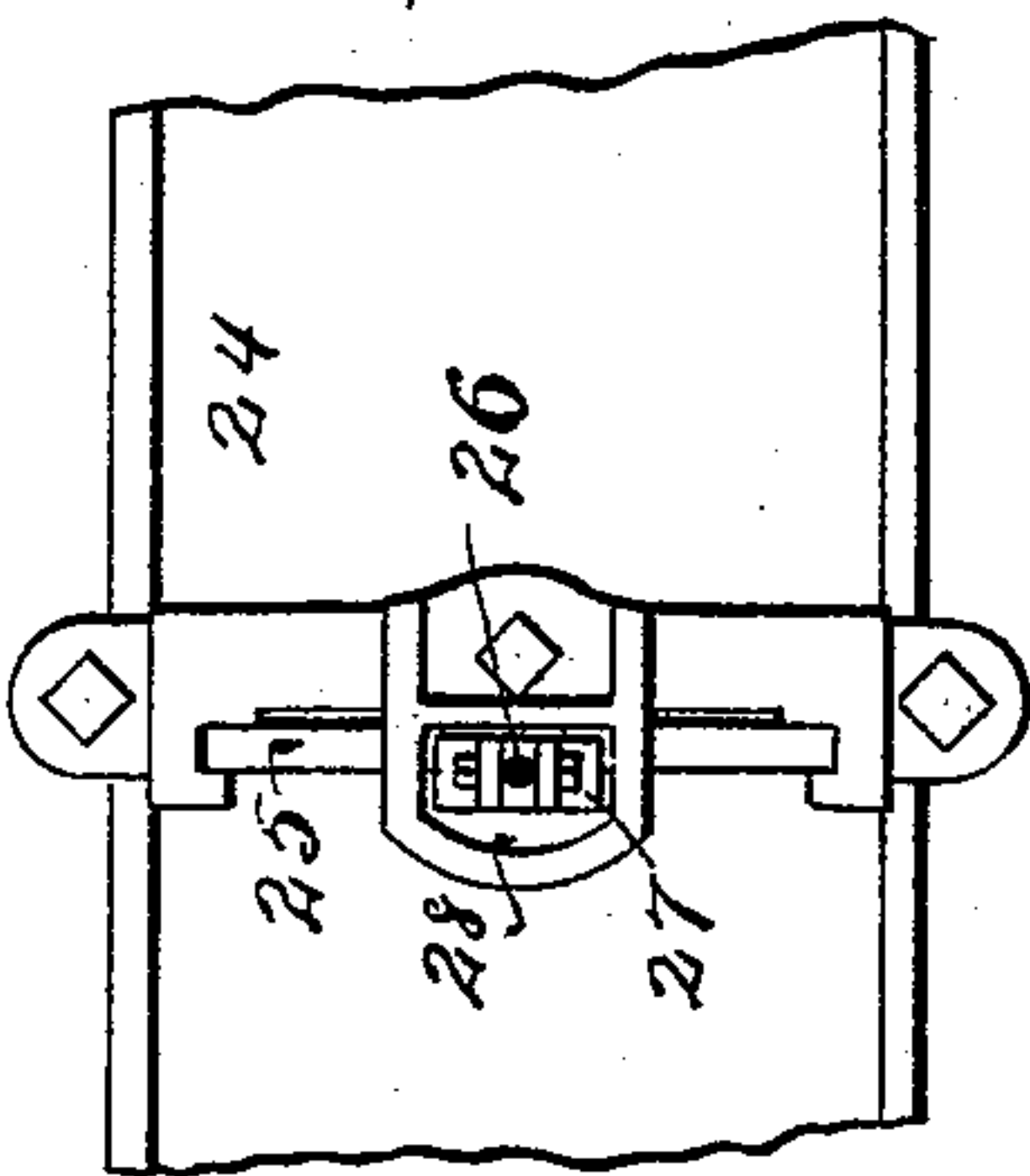
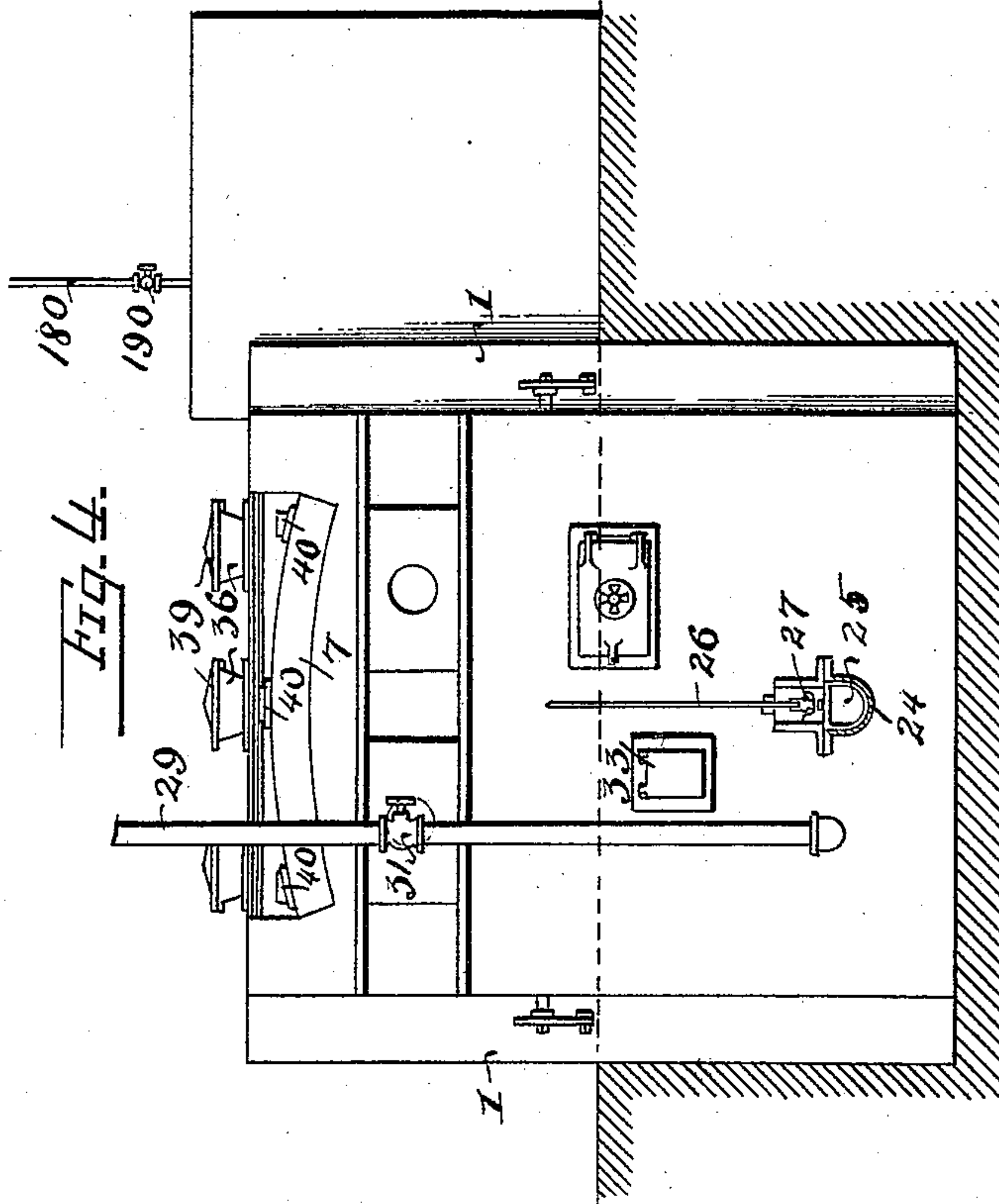
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Jesse B. Heller,
John T. Carr

Inventor.

John S. Dougherty
Attorney.

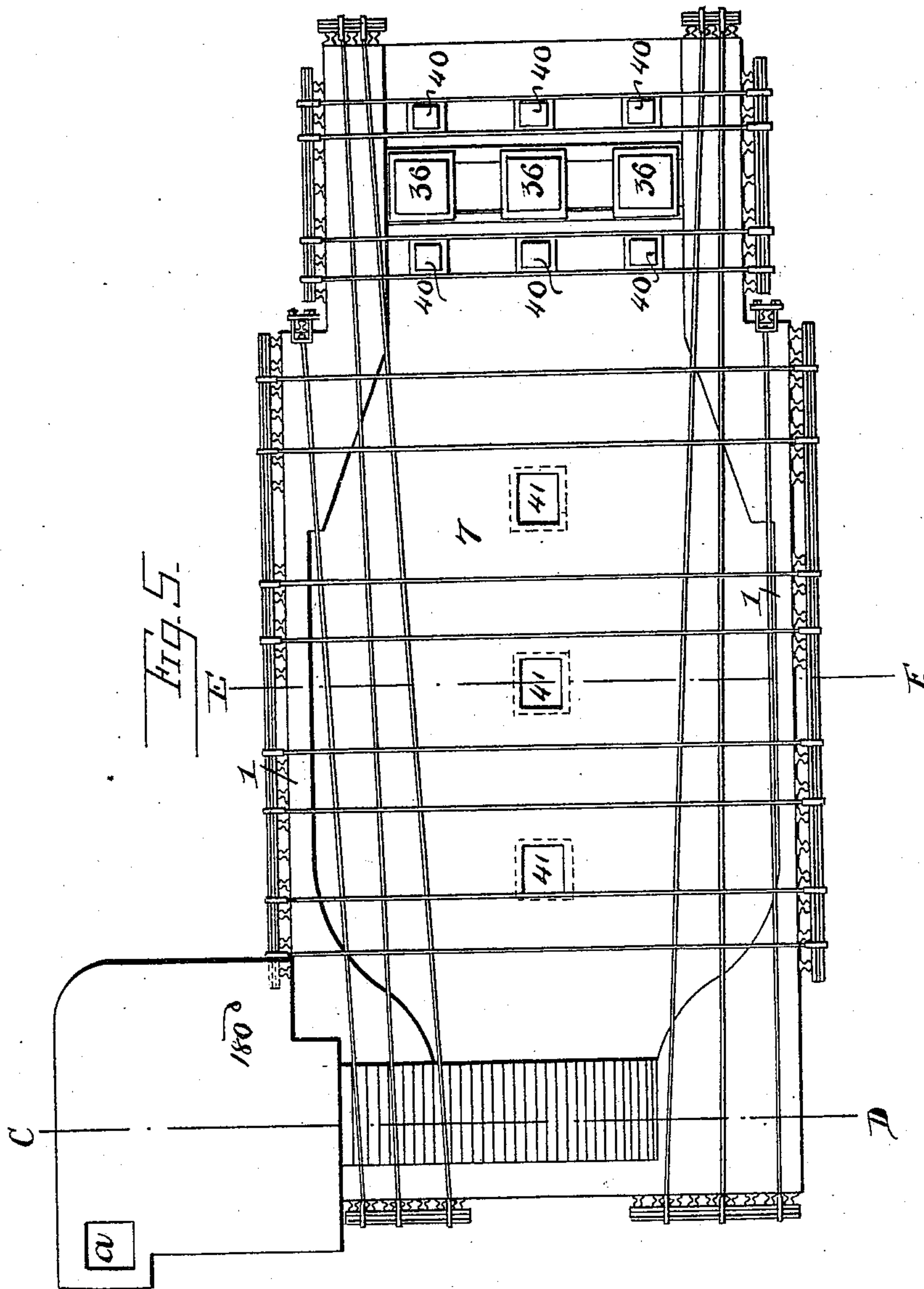
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8 Sheets—Sheet 4.

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No. 541,602.

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Witnesses:

Jesse B. Heller,
John T. Barr

Inventor.

John S. Dougherty,
Wm. H. Harding
Attorney.

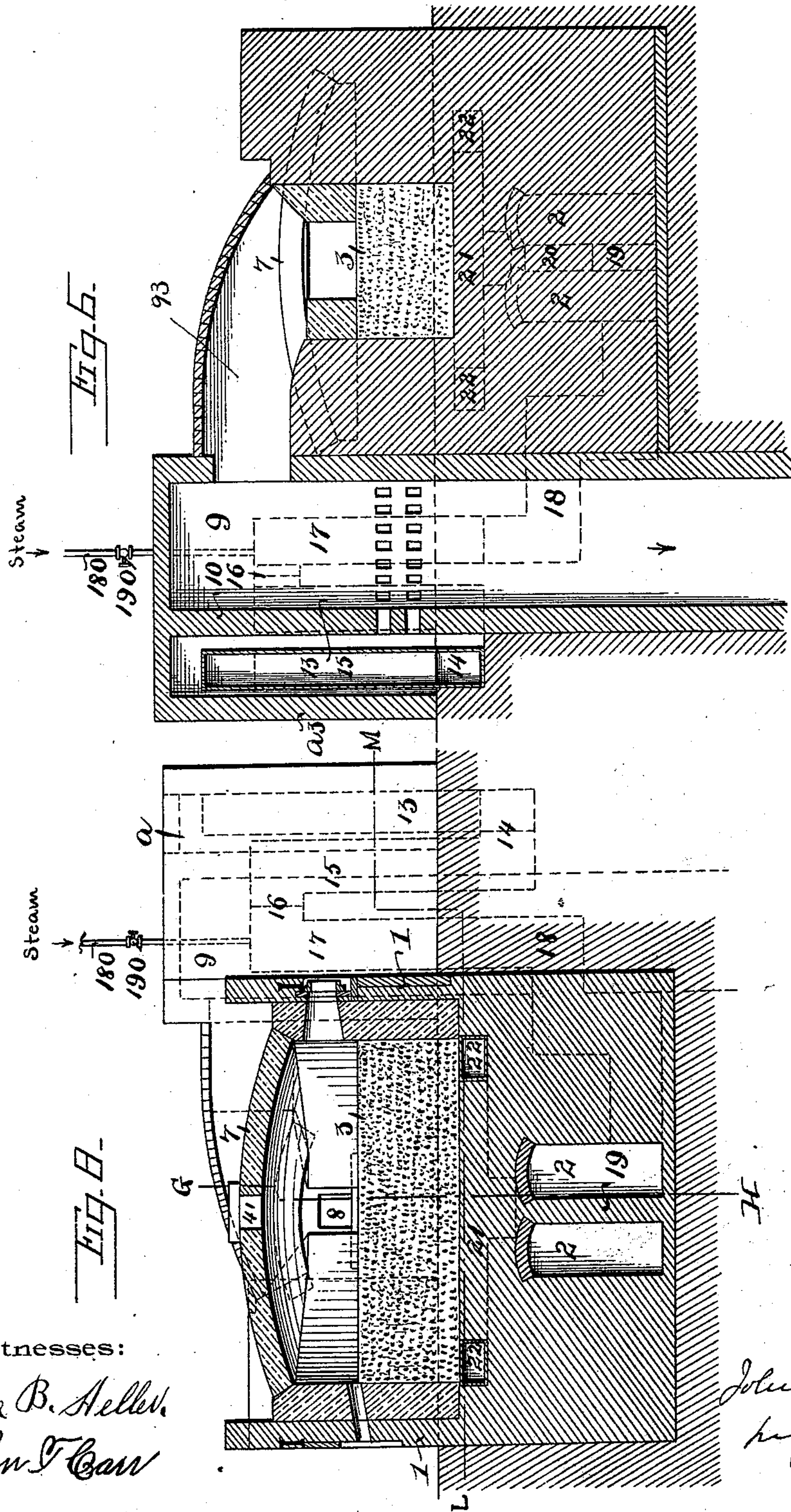
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No. 541,602.

Patented June 25, 1895.



Witnesses:

Jesse B. Heller.
John T. Carr

Inventor,

John S. Dougherty
per J. H. H. H.
Attorney.

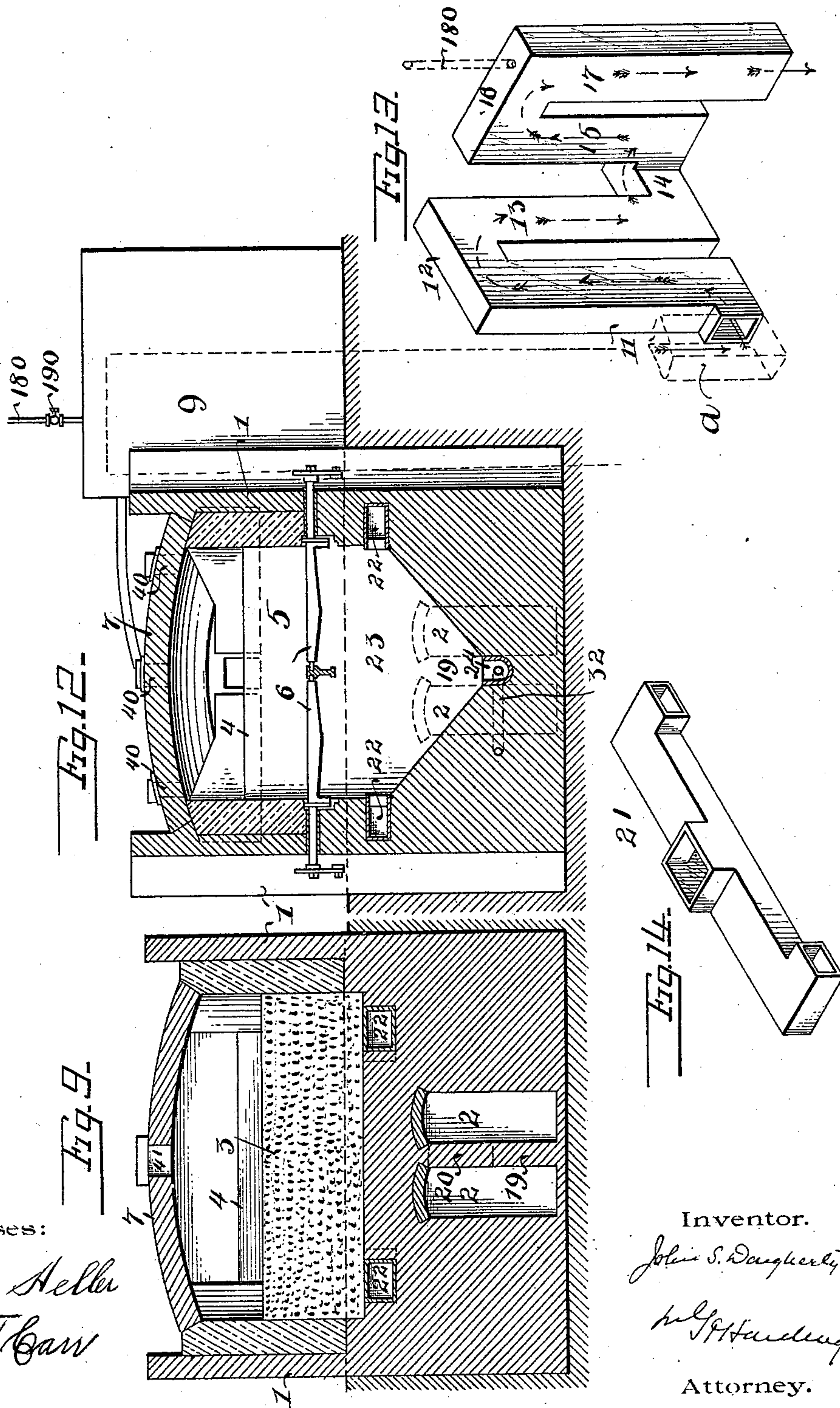
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Witnesses:

Jesse B. Heller
John T. Carr

Inventor.

John S. Dougherty

W. J. Handley

Attorney.

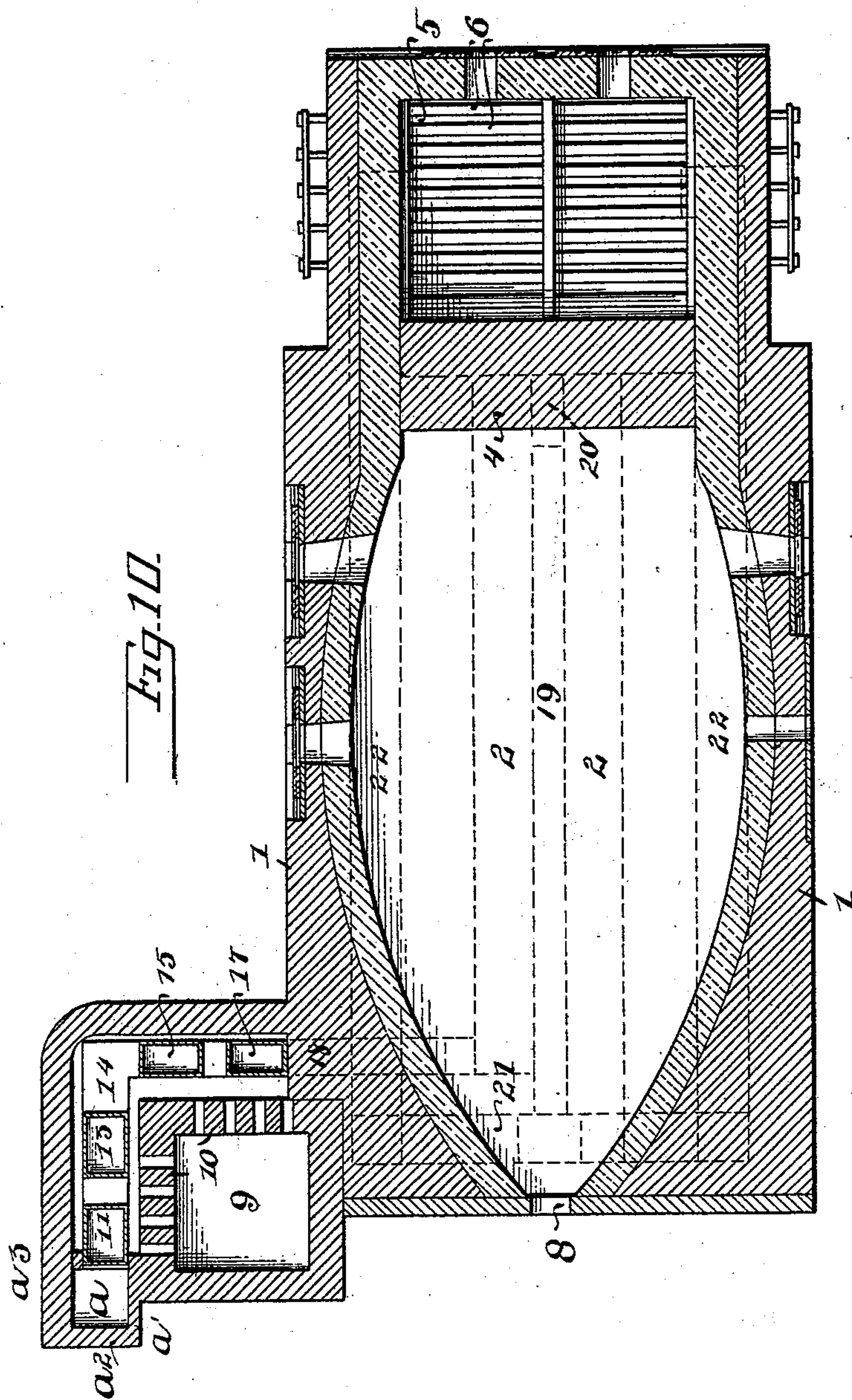
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Witnesses:

Jesse B. Heller.
John T. Carr

Inventor.

John S. Dougherty

Wm. H. Handberg

Attorney.

(No Model.)

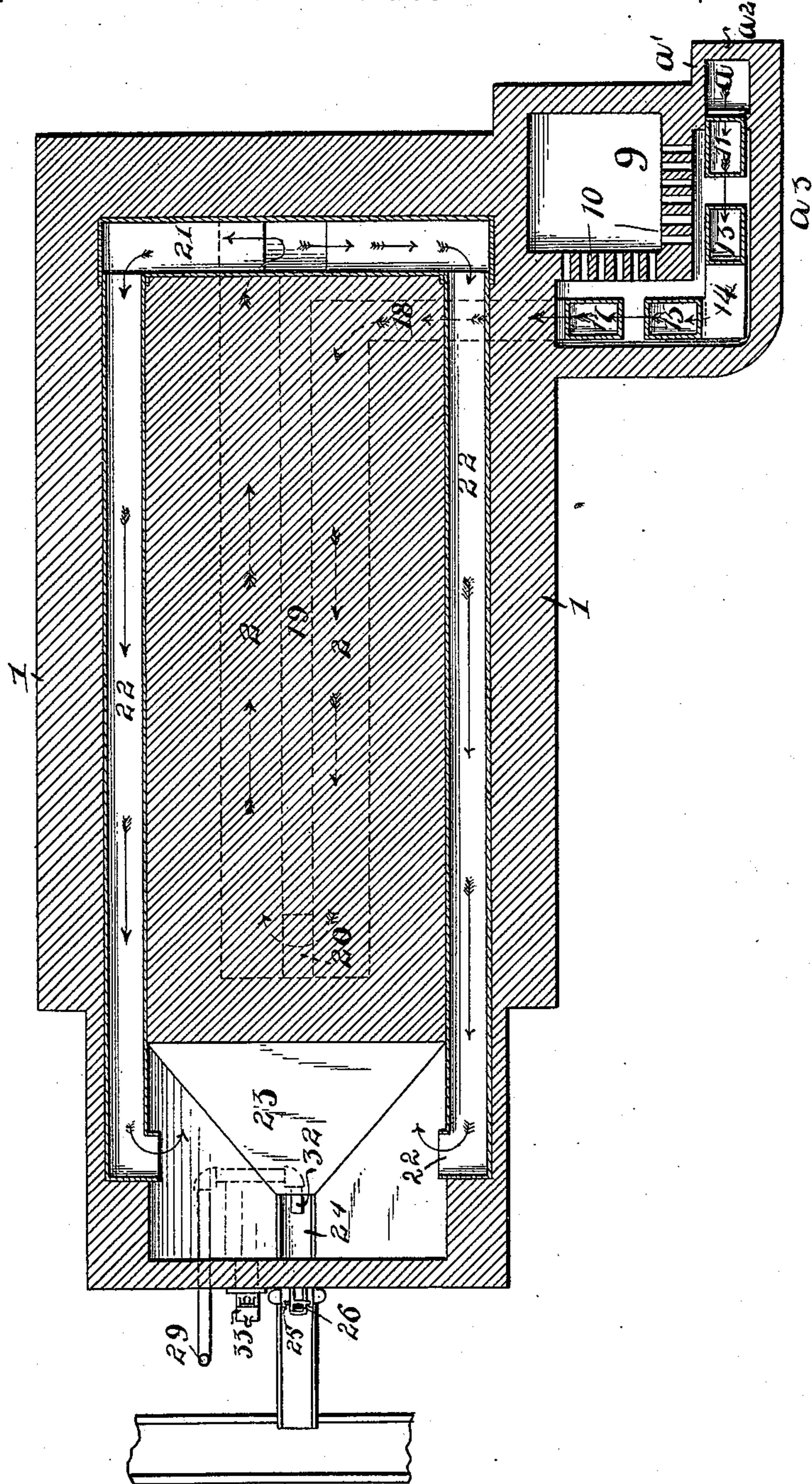
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Fig. 11.



Witnesses:

Jesse B. Heller,
John T. Carr

Inventor.

J. S. Dougherty,
by J. H. Anderson

Attorney.

UNITED STATES PATENT OFFICE.

JOHN S. DOUGHERTY, OF ANACONDA, MONTANA, ASSIGNOR TO MARCUS DALY, OF SAME PLACE.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 541,602, dated June 25, 1895.

Application filed February 16, 1894. Serial No. 500,360. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. DOUGHERTY, a citizen of the United States, residing at Anaconda, county of Deer Lodge, and State of Montana, have invented a new and useful Improvement in Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

Some of my improvements are applicable to furnaces generally, while all are especially applicable to reverberatory or smelting furnaces.

My improvements consist in, first, a novel apparatus for creating draft, which is especially applicable to the burning of coal which is liable to clinker and high in ash, which, under the ordinary condition of draft, is very difficult to burn properly so as to produce a requisite and proper heat; second, in a novel method of clearing the ash pit and removing the ashes without opening the ash pit or otherwise affecting the fire.

In the drawings, Figure 1 is a front elevation of a reverberatory furnace to which is applied my improvement. Fig. 2 is a right-hand side elevation of same. Fig. 3 is a left-hand side elevation of same. Fig. 4 is a rear elevation of same. Fig. 5 is a top plan view of same. Fig. 6 is a section on the line C D, Fig. 5. Fig. 7 is a section on line G H, Fig. 8. Fig. 8 is a section on line J K, Fig. 7. Fig. 9 is a section on line E F, Fig. 5. Fig. 10 is a section on line A B, Fig. 2. Fig. 11 is a section on line L M, Fig. 8. Fig. 12 is a section on line N O, Fig. 7. Fig. 13 is a detached perspective view of air-passages. Fig. 14 is a perspective view of flue 21. Figs. 15, 16, and 17 are detail views of guillotine-gate.

1 are the outer walls of the furnace; 2, the vault beneath the hearth of the furnace; 3, the quartz bottom of the hearth of the furnace; 4, the bridge wall; 5, the combustion chamber having grates 6; 7, the roof of the hearth of the furnace; 8, the slag orifice; 9, the flue or down take opening into the hearth of the furnace, and through which the products of combustion are led downward to a horizontal flue leading to the stack, and 93 is the exit for the gases leading from the hearth to the down take.

Surrounding the flue, 9, on two sides is a wall, 10, and at the top, with the exception of the opening, *a*, closed over to the flue walls. The part marked *a* forms a flue having the walls *a'* and *a''* and wall *a'''* extending beyond the main flue 9. This flue *a* is open at the top, and at the bottom opens in a vertical iron flue 11, which rests between the wall 10 and wall of the flue. This flue 11 extends upward, and at its top is connected by the horizontal passage 12 with another iron flue 13, which in turn, at its bottom is connected by horizontal flue 14 with a third flue 15; and this latter is connected at its top by a horizontal flue 16 with a vertical flue 17. All of these flues are in the space between the walls 10 and the wall of main flue 9, and in the walls of main flue 9, at different places, bricks are removed, leaving openings from said flue 9 to the space between the walls 10 and walls of flue 9, into which the products of combustion pass highly heating the iron flues in said passage.

180 is a pipe leading from a source of steam supply and having the cock 190. This pipe passes through the wall at the roof of space between the wall 10 and the flue 9, and into the iron flue 17. The iron flue 17 projects downward a distance such that its lower end opens into a horizontal brick flue 18 leading to the level of the bottom of the vault 2. This vault is divided into two parts by means of a wall 19, through which wall, at the end opposite to flue 18, is a passage or opening 20.

21 is a horizontal flue extending across the top of the vault and at that end in which is the flue 18. This flue 21 has an opening into the vault in that side of the division wall 19, opposite to the opening of flue 18. At each end of this flue 21 are iron longitudinal flues which extend under the hearth, and have angle ends which terminate at openings in the wall of the ash pit 23 at opposite sides. The ash pit 23 has its front and side walls tapering to a sluice 24, which extends through the rear wall of the ash pit into the flume or main sluice, the sluice being opened or closed by means of a guillotine gate 25. This gate may be operated from the lever of the grate bars or firing door by means of the vertical rod 26, which has a swivel connection with the gate 25. The rod 26 has a projection 27,

which is adapted when in one position to pass through an orifice 28 in a bracket 280 connected to the rear wall, but when the rod 26 is turned the projection cannot pass through the orifice and the gate is held in open position.

29 is a pipe leading from a source of water supply with a head or pressure having a cock 31 at the desired level. A branch 32 extends from this pipe through the wall of ash pit and terminates adjacent to the sluice 24.

The grates 6 used in this furnace are shaking grates with shaking levers at or above the level of the grate bars, and when the grate bars are shaken and the ashes fall into the pit, the cock 31 and gate 25 are opened, and the water carries the ashes and clinkers in the sluice 24 to the flume 30, which extends to the place of deposit.

In order to provide against an accident which might occur if the gate 25 were closed without turning off the water, I provide in the wall of the ash pit, at a point above the gate 25 but below the grates 6, a swing door 33, adapted to swing outward, but normally closed by gravity. If the above should occur, as soon as the water has reached the level of the door 33, it will cause it to swing outward, and the water will pass out and no damage can be done.

In order to save labor and to avoid the necessity of opening the fire door to fire and to reduce the necessity of spreading to a minimum, I use a central hopper 34 into which the coal is placed, and branch pipes 35 lead from said hopper to points over openings 36 in the top of the combustion chamber. Each branch pipe is provided at its end with a sliding cover 37 operated by a lever 38, said openings being provided with covers 39 adapted to swing off the openings when desired. Three openings are shown in the drawings at different points across the top of the combustion chamber and coal can be admitted to all three points of the corresponding portions of the grate surface, or at any one or more of them where fuel is desired. I also provide openings 40 in the top of the combustion chamber for the purpose of removing the clinkers from the walls of the combustion chamber. As shown in the drawings, there are six, three at points across the top of the chamber adjacent to the rear wall, and three across the top adjacent to the bridge wall. Through these openings a rubble or iron bar is inserted and by which the clinkers from the walls adjacent to said openings may be removed. I also provide the following in order to enable the charge to be delivered to the reducing chamber, so as to necessitate as little spreading as possible: At various points between the bridge wall and the front of the furnace, I provide openings 41 in the roof of the furnace, provided with proper caps, three openings being shown in the drawings, and I provide a hopper having branches 42 adjacent to each of these openings. The mouth of each of these branches is provided with a

sliding cover 43 operated by a lever 44, so that the charge is fed into the hearth at three points, and is thus practically evenly distributed over the said chamber requiring little or no spreading.

46 is a series of rock shafts (Figs. 2 and 3) with connected cranks for tilting the grate bars. The rectangular passage 45 in bridge wall 4 is an air flue (Fig. 7).

Speaking generally of the constructions hereinbefore described, the particular purpose of the first—the method of producing draft—with a high ash coal full of impurities, it is difficult to produce proper combustion, and the tendency to form clinkers is very great, and in my method instead of using the draft of ordinary temperature, the draft is produced by the air entering the flue, *a*, and passing through the flues 11, 13, 15 and 17, in the position before described. They become highly heated, being subject not only indirectly but also directly to the action of the heated products of combustion, and having no openings directly between the flue and the interior of flues 11, 13, 15 and 17, no dust or dirt of any consequence will lodge therein. The air passing from said flues to the vault is still under the action of heat, and the air is held under the action of great heat until it passes out into the ash pit. The vault also forms a reservoir to store up this highly heated air, so that air supply will be held sufficient for varying demands. Again, the addition of steam not only adds to the draft, but assists in breaking up the clinkers upon the grate.

I have shown and described four iron flues 11, 13, 15, and 17, but if not so great heat is required, two flues may be used, or, if greater heat is required, a larger number of flues may be used, being placed in the other side of the main flue or down take 9; and also, if this be applied to a furnace in which the flue 9 is the main discharge flue, then said iron flues may be arranged around it. The vault forms a storage place for any dust or dirt which may accumulate in the pipes or flues, as the pipes or flues may be cleaned in either direction to this vault by blast. The method of cleaning the ash pit avoids considerable labor and subserves its purpose most effectively. The method of firing and charging enables the coal and charge to be delivered evenly to the different parts of the combustion chamber and hearth respectively, entailing little or no labor in spreading; and the openings in the top of the combustion chamber enable clinkers to be readily removed from the sides of the combustion chamber and the bridge wall. By these constructions as a whole, the combustion chamber is seldom opened, and the fire thus does not become chilled, and the whole may be operated with but slight labor.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In combination with a combustion cham-

ber, an ash pit, a sluice extending from the interior of said ash pit through the wall, a source of water supply, means to admit said water to the sluice within the ash pit, an opening in the pit wall above the sluice and beneath the grate bars, and a gate or check valve opening outward adapted to automatically close said opening.

2. In combination with a combustion chamber and ash pit provided with sloping walls, a sluice within said ash pit and projecting through the walls of said pit, the walls of said ash pit converging to said sluice, a source of water supply, means to admit said water to said sluice within the ash pit, an opening in the pit wall above the sluice and beneath the grate bars, and a gate or check valve opening outward adapted to automatically close said opening.

3. In a reverberatory furnace in combination with a combustion chamber, a hearth, a vault beneath said hearth, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, flues in said passage, an opening from the air to said flues, a passage from said flues to the vault, and a passage from said vault to a point or points beneath the grate bars.

4. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through said partition, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, flues in said passage, an opening from the air to said flues, a passage from the flues to one portion of the vault at the opposite end to the opening in the division wall, and a passage from the other portion of said vault to a point or points beneath the grate bars.

5. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through said partition, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, flues in said passage an opening from the air to said flues, a passage from the flues to one portion of the vault at the opposite end to the opening through said partition, a flue extending across the end of said vault, and opening into said flue from the other portion of said vault, and a flue leading from each end of said last mentioned flue to opposite points beneath the grate bars.

6. In a reverberatory furnace, in combination with a combustion chamber, a hearth, a vault beneath said hearth, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, openings between said flue and said passage, flues in said passage, an opening from the air to said flues, a passage from said flues to the vault, and a passage from said vault to a point or points beneath the grate bars.

7. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through said partition, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, openings between said flue and said passage, flues in said passage, an opening from the air to said flues, a passage from the flues to one portion of the vault at the opposite end to the opening through said partition, and a passage from the other portion of said vault to a point or points beneath the grate bars.

8. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through said partition, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, openings between said flue and said passage, flues in said passage an opening from the air to said flues, a passage from the flues to one portion of the vault at the opposite end to the opening through said partition, a flue extending across the end of said vault and opening into said flue from the other portion of said vault, and a flue leading from each end of said last mentioned flue to opposite points beneath the grate bars.

9. In a reverberatory furnace in combination with a combustion chamber, a hearth, a vault beneath said hearth, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, flues in said passage, an opening from the air to said flues, a source of steam supply and connection between said source of steam supply and said flues, a passage from said flues to the vault, and a passage from said vault to a point or points beneath the grate bars.

10. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through said partition, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, flues in said passage an opening from the air to said flues, a source of steam supply and connection between said source of steam supply and said flues, a passage from the flues to one portion of the vault at the opposite end to the opening through said partition, and a passage from the other portion of said vault to a point or points beneath the grate bars.

11. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through said partition, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, flues in said passage an opening from the air to said flues, a source of steam supply, and con-

nection between said source of steam supply and said flues, a passage from the flues to one portion of the vault at the opposite end to the opening through said partition, a flue
5 extending across the end of said vault, and opening into said flue from the other portion of said vault, and a flue leading from each end of said last mentioned flue to opposite points beneath the grate bars.
10 12. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through said partition, a flue to carry off the products
15 of combustion from the furnace, a passage surrounding said flue in part or in whole, openings between said flue and said passage, flues in said passage an opening from the air to said flues, a source of steam supply
20 and connection between said source of steam supply and said flues, a passage from the flues to one portion of the vault at the opposite end to the opening through said partition, and a passage from the other portion of said
25 vault to a point or points beneath the grate bars.

13. In a reverberatory furnace, in combination, a combustion chamber, a hearth, a vault beneath said hearth, said vault being divided by a partition, and an opening through
30 said partition, a flue to carry off the products of combustion from the furnace, a passage surrounding said flue in part or in whole, openings between said flue and said passage, flues in said passage an opening from the air
35 to said flues, a source of steam supply and connection between said source of steam supply and said flues, a passage from the flues to one portion of the vault at the opposite end to the opening through said partition, a
40 flue extending across the end of said vault and opening into said flue from the other portion of said vault, and a flue leading from each end of said last mentioned flue to opposite points beneath the grate bars.
45

In testimony of which invention I have hereunto set my hand.

JOHN S. DOUGHERTY.

Witnesses:

W. E. PRENDERGAST,
ALEX. DEVINE.