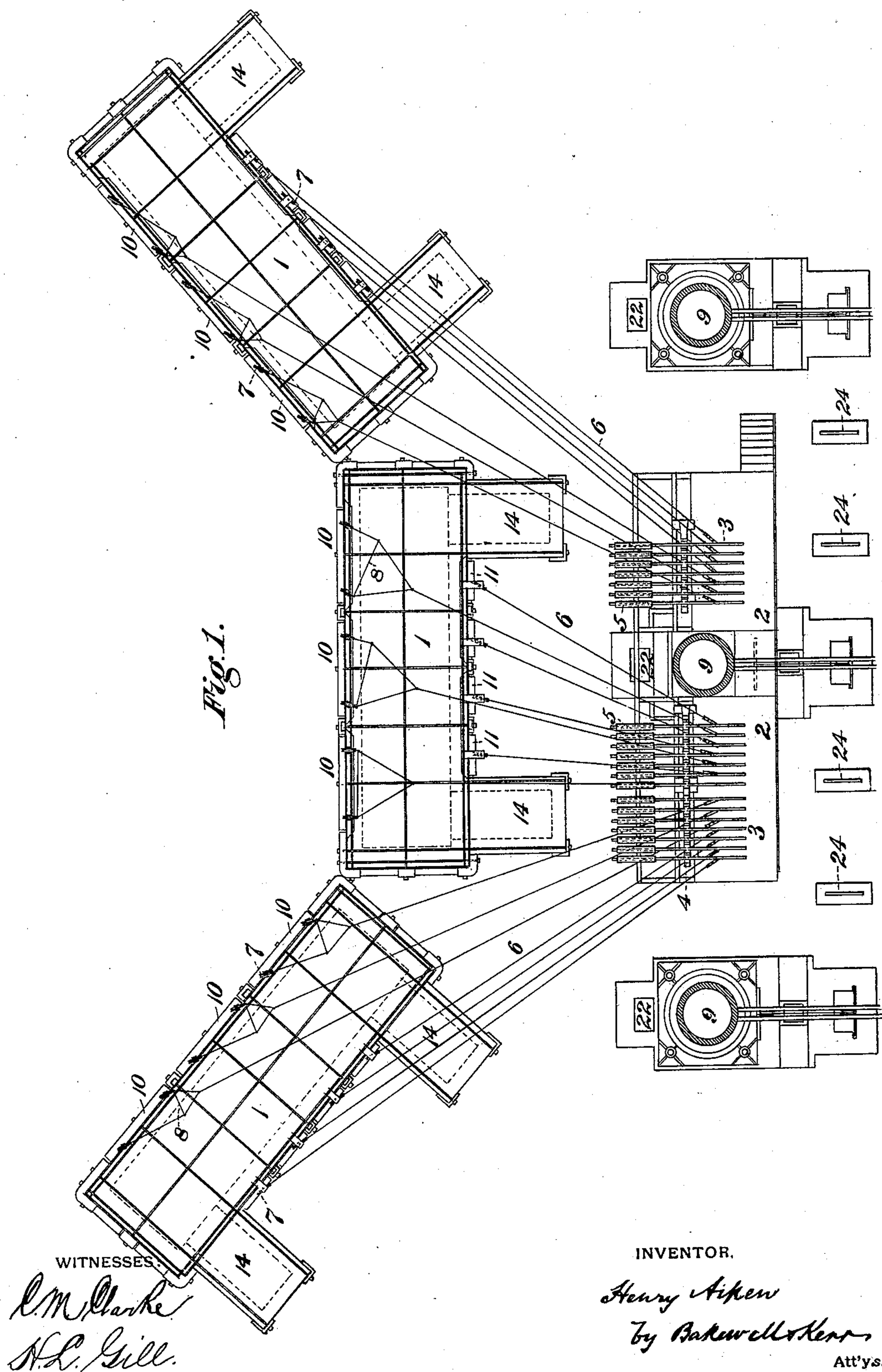


5 Sheets—Sheet 1.

No. 405,240.

Patented June 18, 1889.



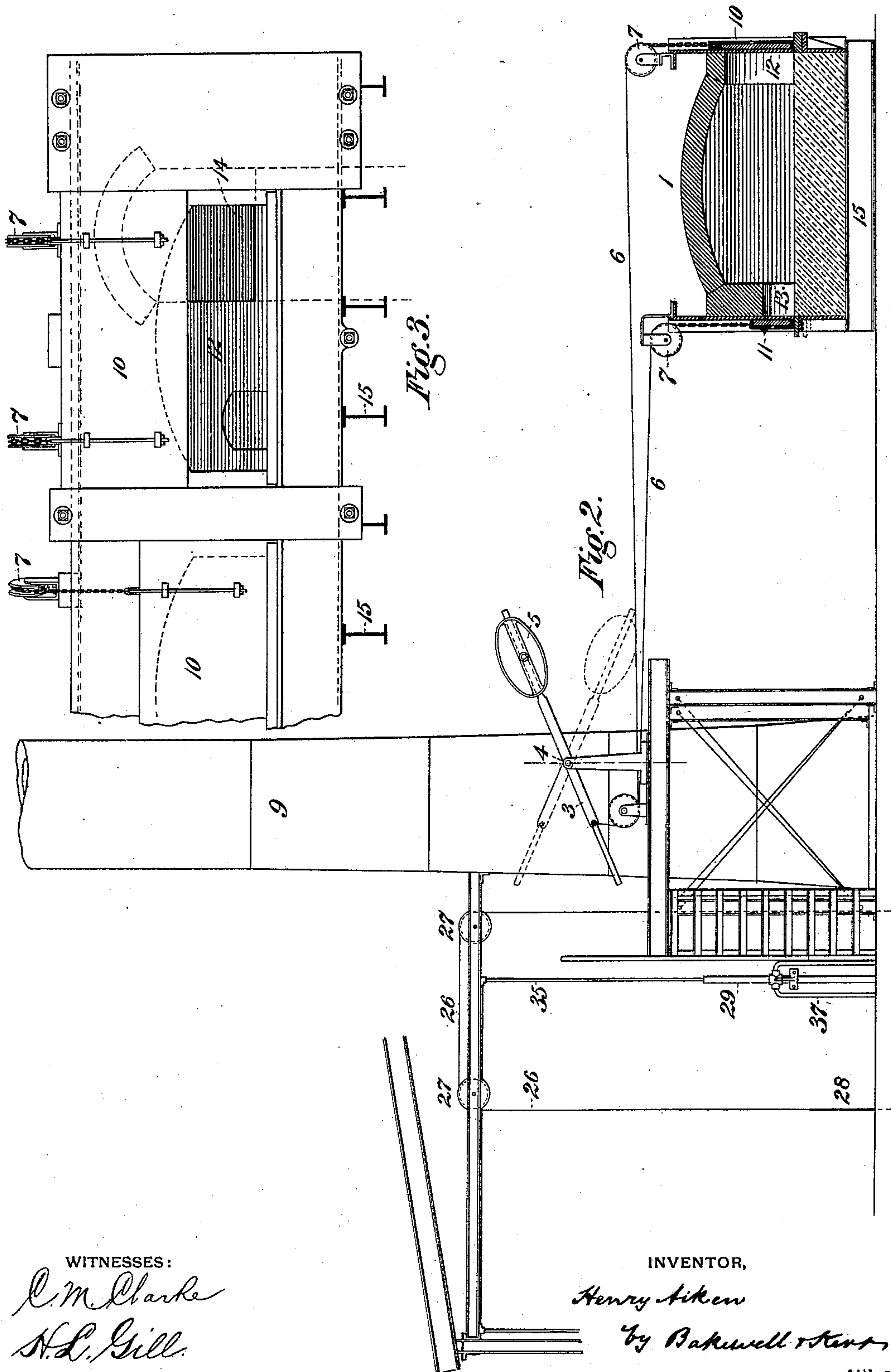
(No Model.)

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H. AIKEN.
REGENERATIVE HEATING FURNACE.

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Patented June 18, 1889.



WITNESSES:

E. M. Clarke
H. L. Gill

INVENTOR,

Henry Aiken

by Bakerwell & Kent

Att'ys.

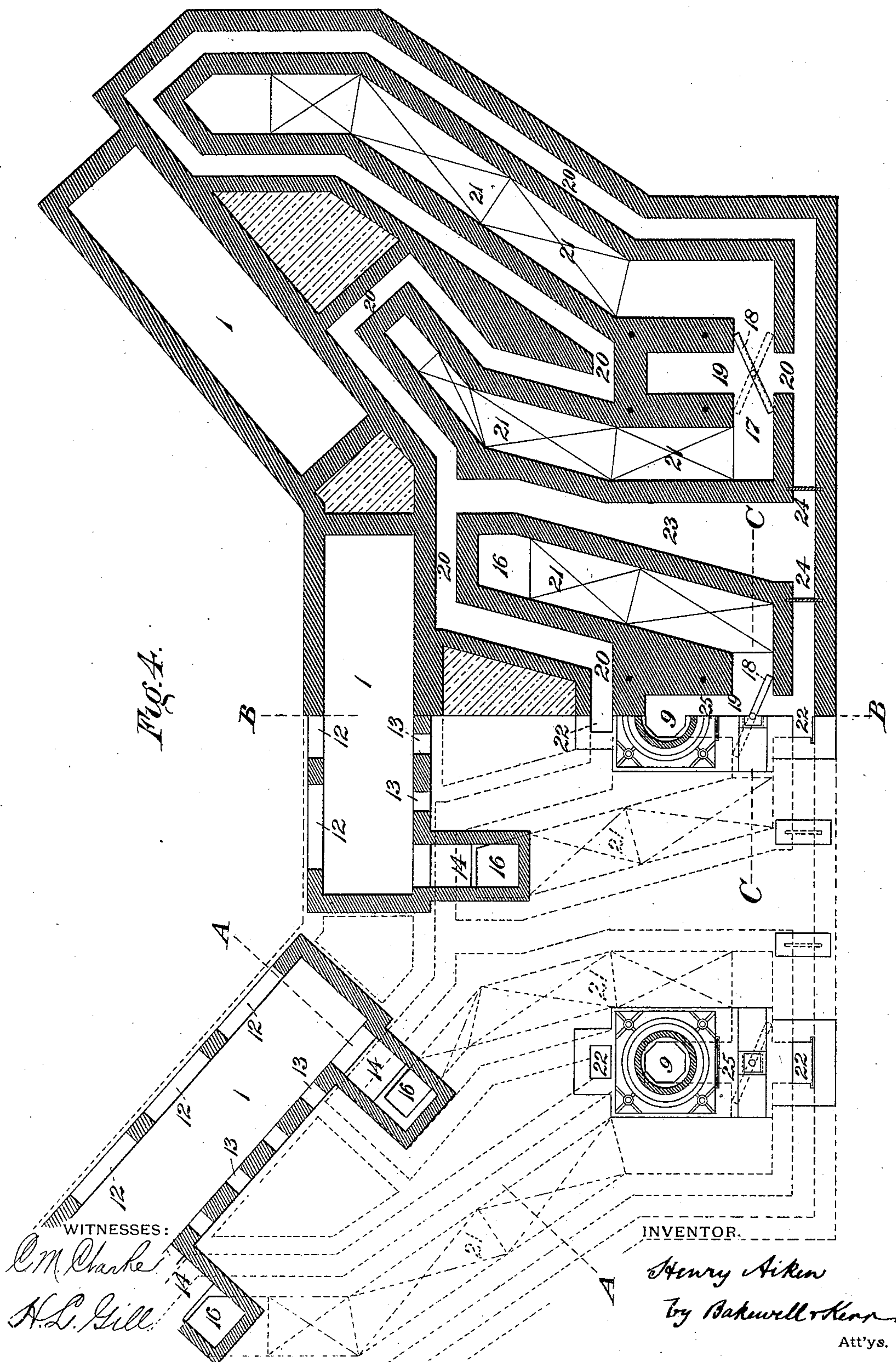
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H. AIKEN.
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5 Sheets—Sheet 4.

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Fig. 8.

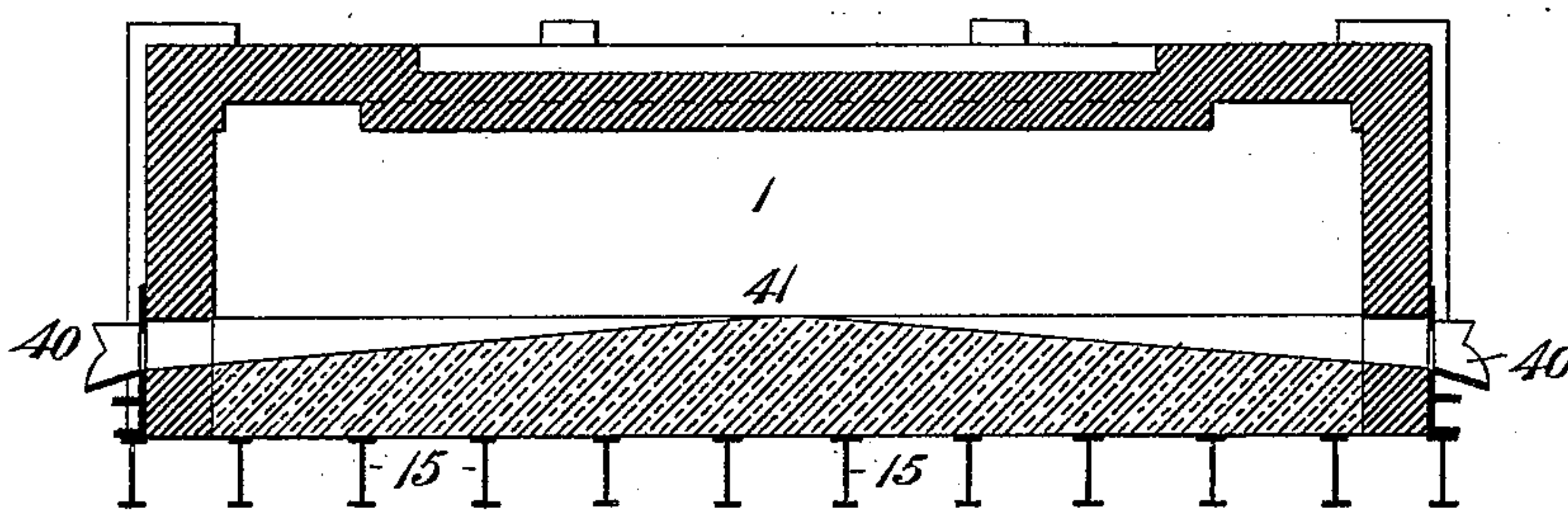
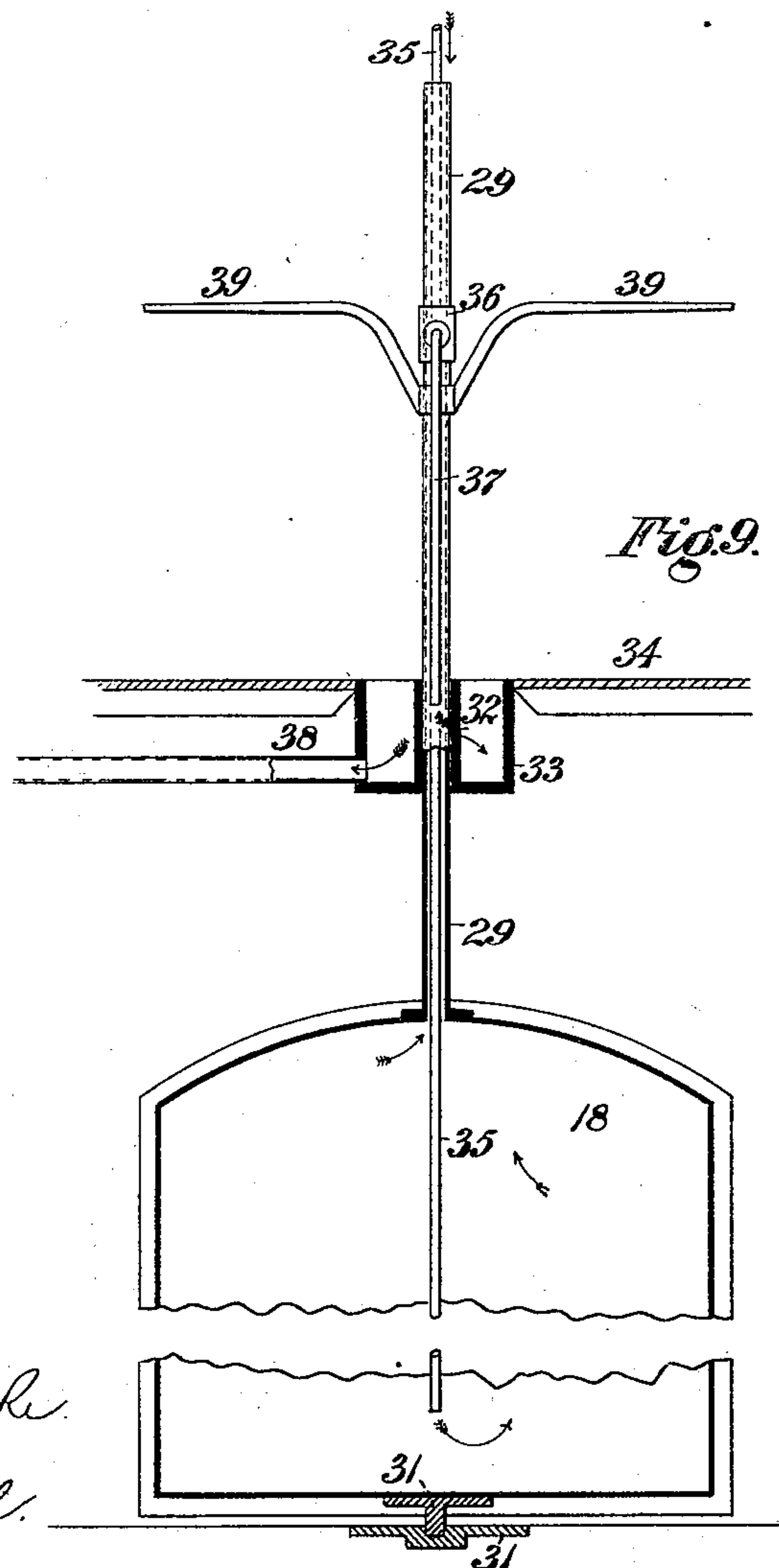


Fig. 9.



WITNESSES:

C. M. Clarke.
H. L. Gill.

INVENTOR,

Henry Aiken
by Bakewell & Son
Att'ys.

UNITED STATES PATENT OFFICE.

HENRY AIKEN, OF HOMESTEAD, PENNSYLVANIA.

REGENERATIVE HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 405,240, dated June 18, 1889.

Application filed June 4, 1887. Serial No. 240,240. (No model.)

To all whom it may concern:

Be it known that I, HENRY AIKEN, of Homestead, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Regenerative Furnaces for Heating Blanks; and I do hereby declare the following to be a full, clear, and exact description thereof.

My improvement relates to the construction and operation of heating-furnaces, and is particularly adapted to the operation of a group of such furnaces arranged with reference to a crane for charging and discharging the same. Such an arrangement is illustrated in Figure 1.

To enable others skilled in the art to use my improvement, I will now describe it by reference to the accompanying five sheets of drawings, in which—

Figure 1, Sheet 1, is a plan view of my improved furnace-plant. Fig. 2, Sheet 2, is an elevation of a portion of the same, showing one of the furnaces in vertical cross-section. Fig. 3, Sheet 2, is a front elevation of a portion of one of the furnaces. Fig. 4, Sheet 3, is a plan view of the group of three furnaces shown in Fig. 1, showing the regenerators, flues, and reversing-valves. Figs. 5, 6, and 7, Sheet 4, are cross-sections on the lines A A, B B, and C C of Fig. 4, respectively. Fig. 8 is a longitudinal vertical section of the bed of the furnace. Fig. 9 is an enlarged view of the reversing-valve.

Like figures of reference indicate like parts in the several figures.

In Fig. 1 I show a group of three of my improved furnaces arranged in the arc of a circle, in the center of which a crane for charging and discharging the furnaces may be arranged. Directly back of the middle furnace is a raised platform or pulpit 2, upon which are three series of levers 3, mounted on a shaft or shafts 4, and provided with counter-weights 5. Each of these levers is connected to a chain or wire rope 6, which leads to a sheave or sheaves 7, journaled on the top edge of one of the furnaces directly over a door controlling one of the openings to the furnace. Where the door is narrow, as is the case with the rear doors of the furnaces in this instance, a single sheave or guide is sufficient, as the door can easily be raised by a single-rope con-

nection; but where, as in the case of the front doors in the present instance, the doors are very wide, a double-rope connection is desirable, if not absolutely necessary. Hence I have divided the rope at the front doors and make use of two sheaves or guides, as shown, and in order to get a direct pull I insert between the branches of the rope a bar or rod 8, which stands at right angles to the line of the single rope which leads from the lever 3. In the present instance each furnace has three front doors and four back doors, and there is a separate lever for each on the pulpit 2, so that each furnace is served by a series of seven levers, and any door in any one of the three furnaces may be operated from the pulpit whenever desired. The great advantage of this arrangement is that all the doors of the furnaces can be operated by one man easily and quickly, so that there is not only a large saving of labor, but the furnaces are served more uniformly and expeditiously than by the old arrangement, where the doors were raised and lowered by separate levers pivoted to the side of the furnace, such arrangement requiring the operator to walk around the furnace and to exert considerable manual labor and strength in moving the door.

By my improved arrangement the doors are operated by the pulpit-man on a signal from the heater who has charge of the furnaces. The position of the pulpit-man being above the furnaces, enables him to see the heater and to operate any particular door merely upon the wave of the hand of the heater. The counter-weights 5 are of sufficient weight to render the operation of the doors by the levers very easy, and being attached directly to the lever, instead of suspended therefrom by chains, they do not interfere with the floor-space below or in front of the pulpit.

In Figs 2 and 3 I illustrate the operation of the doors. The front doors 10, which control the wide front openings 12, are large and wide, so that when raised nearly the entire front of the furnace is open, whereby the work of charging and discharging the bed is greatly facilitated and valuable space is economized. The work-holes 13 are all arranged at the rear side of the furnace, and are controlled by the small doors 11.

The beds of the furnaces are supported on

I-beams 15, so as to have a free circulation of air thereunder. This construction is not only very strong and affords a very firm foundation, but makes the greatest possible exposure of the bottom of the furnace to the air.

The furnaces as illustrated are designed for operation with natural gas, and consequently the whole purpose of the regenerators is to heat the air.

In Fig. 4 I show a plan view, partly in section, which illustrates the arrangement of the flues and regenerators of the group of furnaces as well as the reversing-valves. In the rear of each furnace 1 is a chamber 14, into which the flues leading to the regenerators open. The regenerators are arranged in the horizontal flues which lead to the stacks 9. They communicate with the chambers 14 by means of vertical flues 16, and lead thence to the opposite sides of the stack, with which they communicate by a lateral flue 17, in the center of which is arranged the reversing-valve 18. The stack-flue 19 runs out of one side of the flue 17, and the air-flue 20 opens into the opposite side. The valve 18 is a vertical butterfly-valve, and has its seats on the opposite sides of the flue 17. When in one position, it connects one of the regenerators 21 with the stack-flue 19 and the other with the air-flue 20. The air enters the flue 20 by openings 22 and circulates around the outer walls of the regenerators 21, as indicated by the arrows in Fig. 4. This provision of the circulating-flues 20 is made to prevent the heating of the walls of the regenerators, and thereby obviates what has heretofore been a serious trouble in the use of these furnaces. The air is more or less heated in its passage through the flue 20, so that in addition to the utility of the flue 20 in keeping down the temperature of the regenerator-walls, and thereby preserving them, it has the further advantage of utilizing the heat therefrom in raising the temperature of the air of combustion.

I herein make no claim for the flue 20 as applied to a single furnace; but it will be noticed that between each separate set of regenerators in this application there is an intermediate air-flue 23 connected with the flue 20, and that at the outer end of this air-flue valves or dampers 24 are placed, which cut off the sets of regenerators from each other. In case it is desired to throw the sets of regenerators together into one common system, serving equally all of the furnaces, the valves 24 may be raised and the flues 20 and 23 all thrown together, so that the air circulates freely through the whole system and the currents lead both ways to each reversing-valve. The provision of the intermediate flues 23 permits access to be had to the outer sides of the adjacent walls of any two of the regenerators for purposes of repair, inspection, &c. The dampers 24 enable any furnace to be cut out of the group without interfering with the operation of either of the others. A damper 25

is provided in the stack-flue 19, Figs. 2, 4, and 6, whereby the draft of the stack can be regulated or entirely cut off. This damper is suspended by a chain or wire rope 26, which passes over sheaves 27 and is provided with a suitable counter-weight 28. The reversing-valves 18, Fig. 9, are made hollow and are provided with a hollow stem 29 and at the lower edge with a central pin or projection 30 in the same axial line as the stem 29. The pin 30 is stepped in a suitable plate 31, and the stem has its bearing in the central tube 32 of a metal waste-water trough or receptacle 33, placed in the floor 34. A water-supply pipe 35 extends down through the hollow stem 29 and terminates in the interior of the valve, the supply-pipe being sufficiently smaller than the stem to permit the waste water to ascend the stem outside of the supply-pipe to a point above the floor, where a cross-fitting 36 is placed, said fitting having waste-pipes 37 connected to its side openings, which lead down to and discharge into the trough or receptacle 33. The trough 33 has an outlet-pipe 38, which leads to a proper point of discharge. The course of the water by which the valves are kept cool and thereby protected from injury by the heat is indicated by the arrows in Fig. 9. It enters the valve by the supply-pipe 35 and passes thence to the outlet-pipe 38 by means of the hollow stem 29, waste-pipes 37, and trough 33. The valves are provided with lever-handles 39 for turning them. I do not in this case make any claim for the construction of the reversing-valves.

The furnaces 1 are provided with slag-holes 40, Fig. 8, at the ends, and the bottoms 41 are inclined both ways from the middle to conduct the slag to the holes. This construction causes the furnace to drain at the ends and leaves the sides completely free to be used for the doors, which is of especial advantage where it is desirable to open up the charging-side, as in the present instance, as much as possible for greater freedom in charging and discharging, and for the purpose of utilizing the entire surface of the bed for receiving the ingots or other articles to be heated. I do not, however, limit myself to heating-furnaces alone, as the means described for operating the doors may be used also for puddling, boiling, or other like furnaces.

A wheel and axle may be used instead of a lever as an equivalent means for operating the doors. The pipe which supplies the natural gas is shown at 42, Figs. 5 and 6.

By having a chamber 14 in the rear of each end of the heating-furnace, as a means of communication between the hearth or bed and the regenerators, I not only obtain the advantage of utilizing the entire length of the furnace for work purposes and have the front entirely clear, but I am enabled to bring the heat into the bed without passing under it and injuriously heating up the masonry of the hearth; and by its compact structure I

am enabled to bind the furnace firmly together by buckstaves and tie-rods, and thereby largely prevent its deterioration by the cracking and traveling of the bed. This construction also enables me to group a number of these furnaces more nearly together around a common center, thereby effecting economy of space and wall-work, as well as utilizing more perfectly the crane. It also enables me to construct the flue 20 between the regenerators and the bed, so as to protect the rear side of the latter from the heat of the regenerators, which, in the absence of such flue, would heat up the intermediate walls and earth to such an extent as to melt down the walls of the bed and destroy them.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of a heating or similar furnace having several doors, with a pulpit having levers mounted thereon for operating the doors separately, and ropes connecting said levers with the doors, substantially as and for the purposes described.

2. The combination of a heating or similar furnace having a wide door, a lever for operating said door, situate at a distance from and at an angle to said door, a rope connecting said door to its operating-lever, said rope being divided and attached to the door at two separate points, and a rod or bar inserted between the branches of the rope at right angles to the rope, and suitable guides over which the rope passes, substantially as and for the purposes described.

3. A heating-furnace having flues at the rear of each end for the entrance of the burn-

ing gases and the exit of the consumed products of combustion, said furnace having its charging and discharging side provided with closely-contiguous doors, whereby, practically, the whole side can be thrown open, substantially as and for the purposes described.

4. A heating-furnace having its charging and discharging side provided with closely-contiguous doors, whereby, practically, the whole side can be thrown open, end slag holes, and an inclined bottom, substantially as and for the purposes described.

5. The combination of several furnaces, each having horizontal regenerators, with a common air-flue extending around all the regenerators, and dampers in the air-flue between the several sets of regenerators, whereby each set can be cut off or connected with the other set or sets, substantially as and for the purposes described.

6. The combination of a heating-furnace with a rear chamber at each end, a reversing-valve, underground flues extending clear of the furnace-walls to the reversing-valve, upright flues connecting the said rear chambers with the underground flues, and regenerators arranged in the underground flues between the rear chambers and the reversing-valve, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 30th day of April, A. D. 1887.

HENRY AIKEN.

Witnesses:

THOMAS W. BAKEWELL,
W. B. CORWIN.