

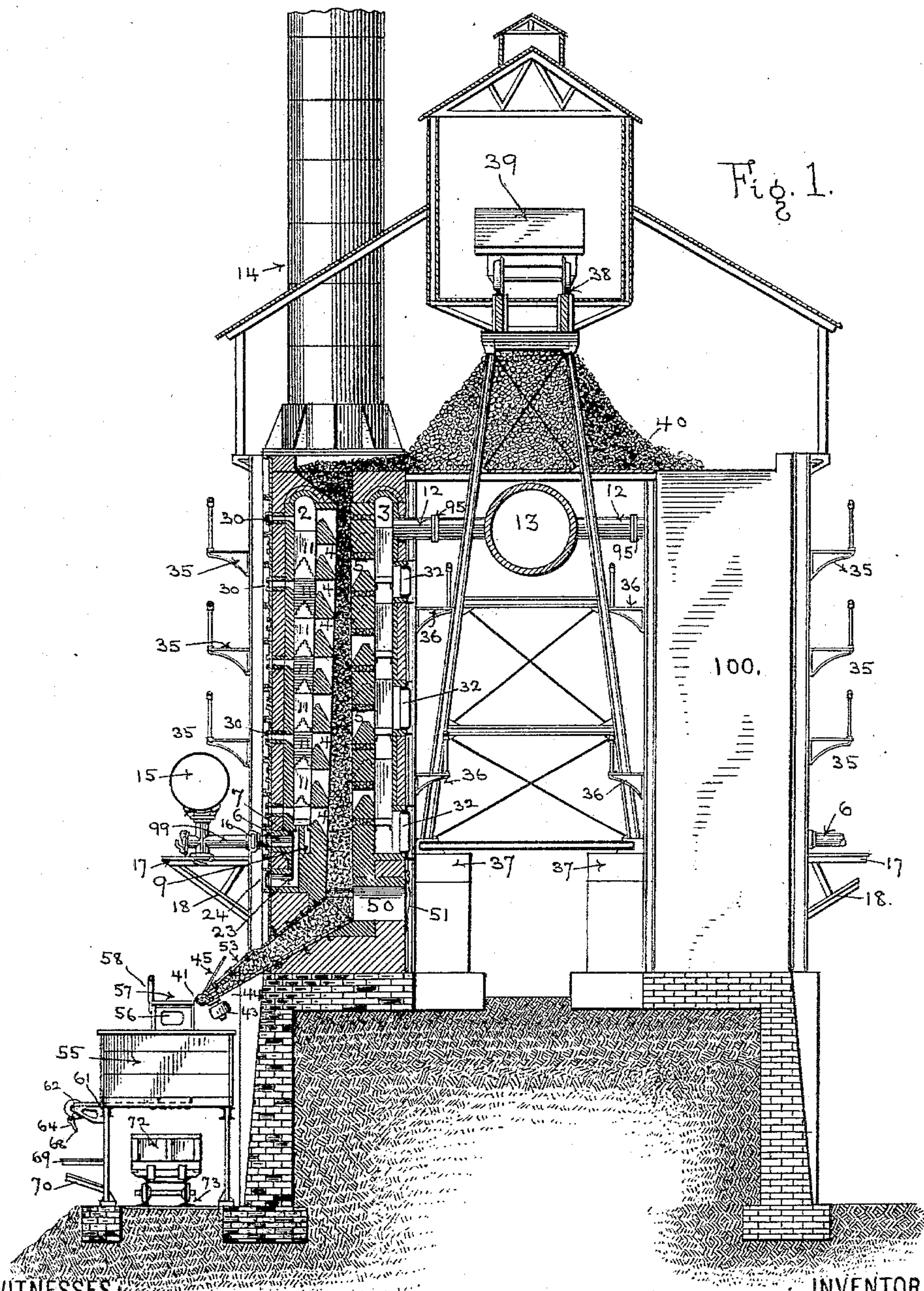
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6 Sheets—Sheet 1.

H. WEHRUM.  
FURNACE FOR ROASTING ORES.

No. 597,629.

Patented Jan. 18, 1898.



WITNESSES:

*Geo Maylor.*

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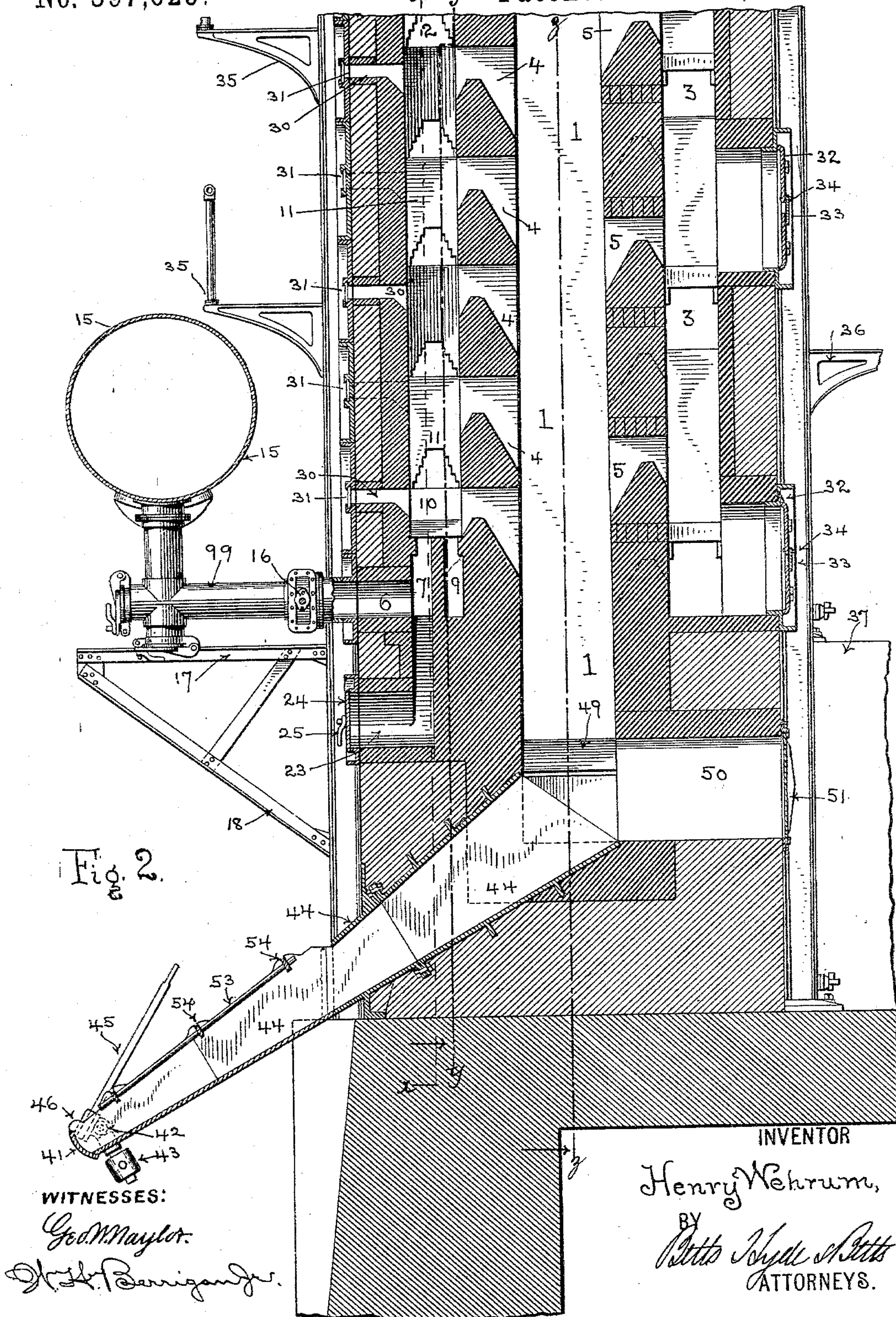
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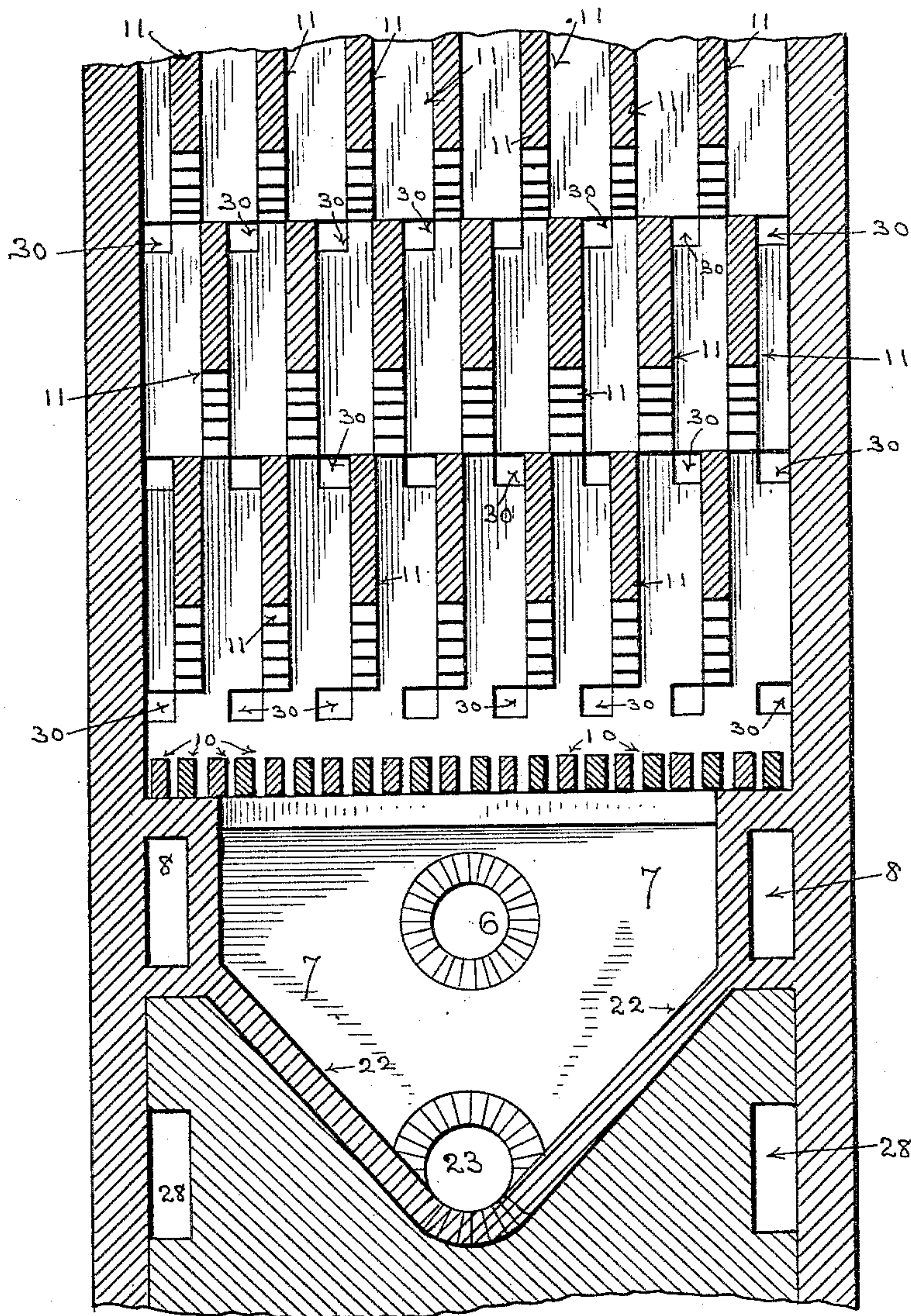


Fig. 3.

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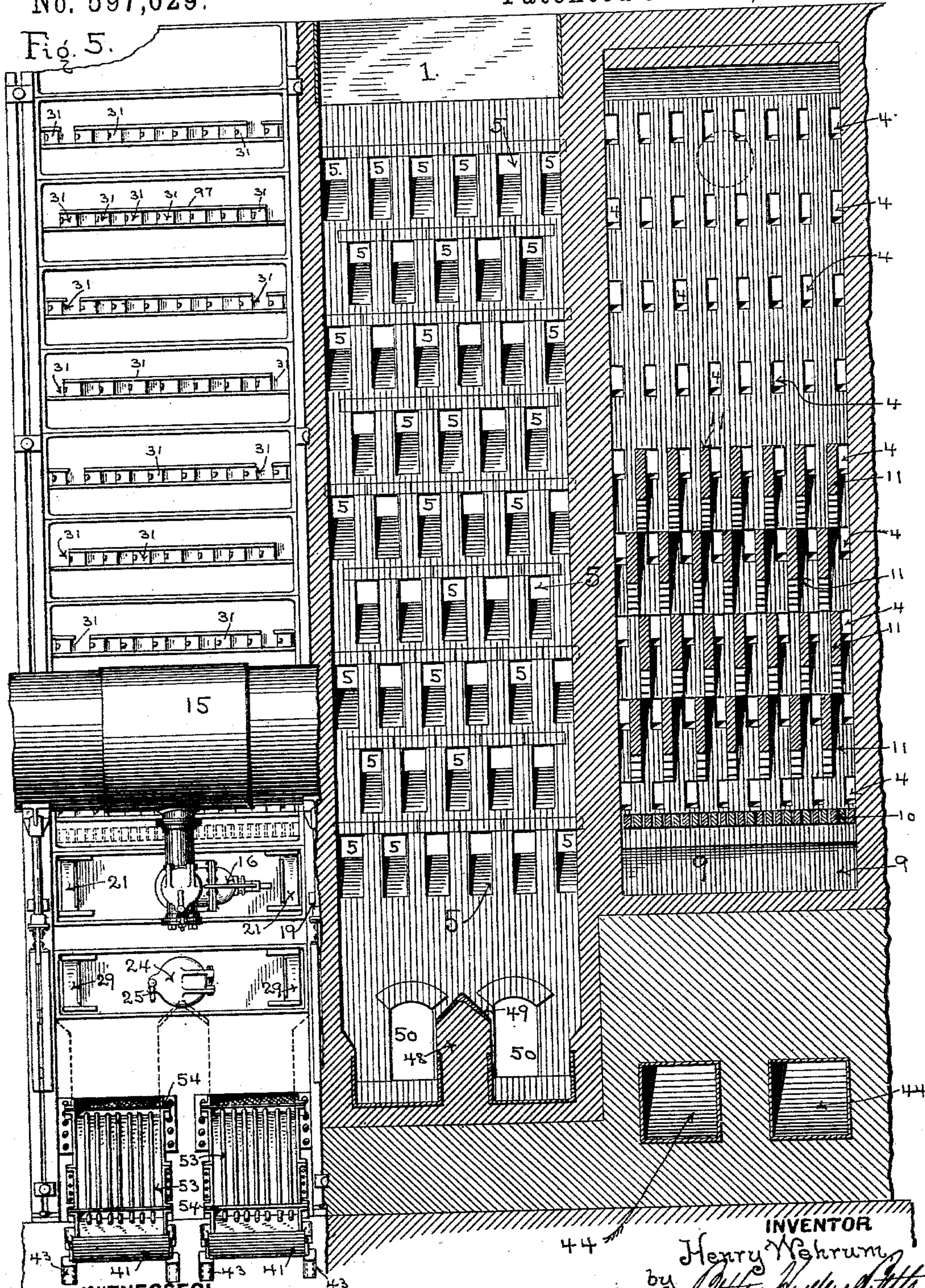
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Fig. 5.



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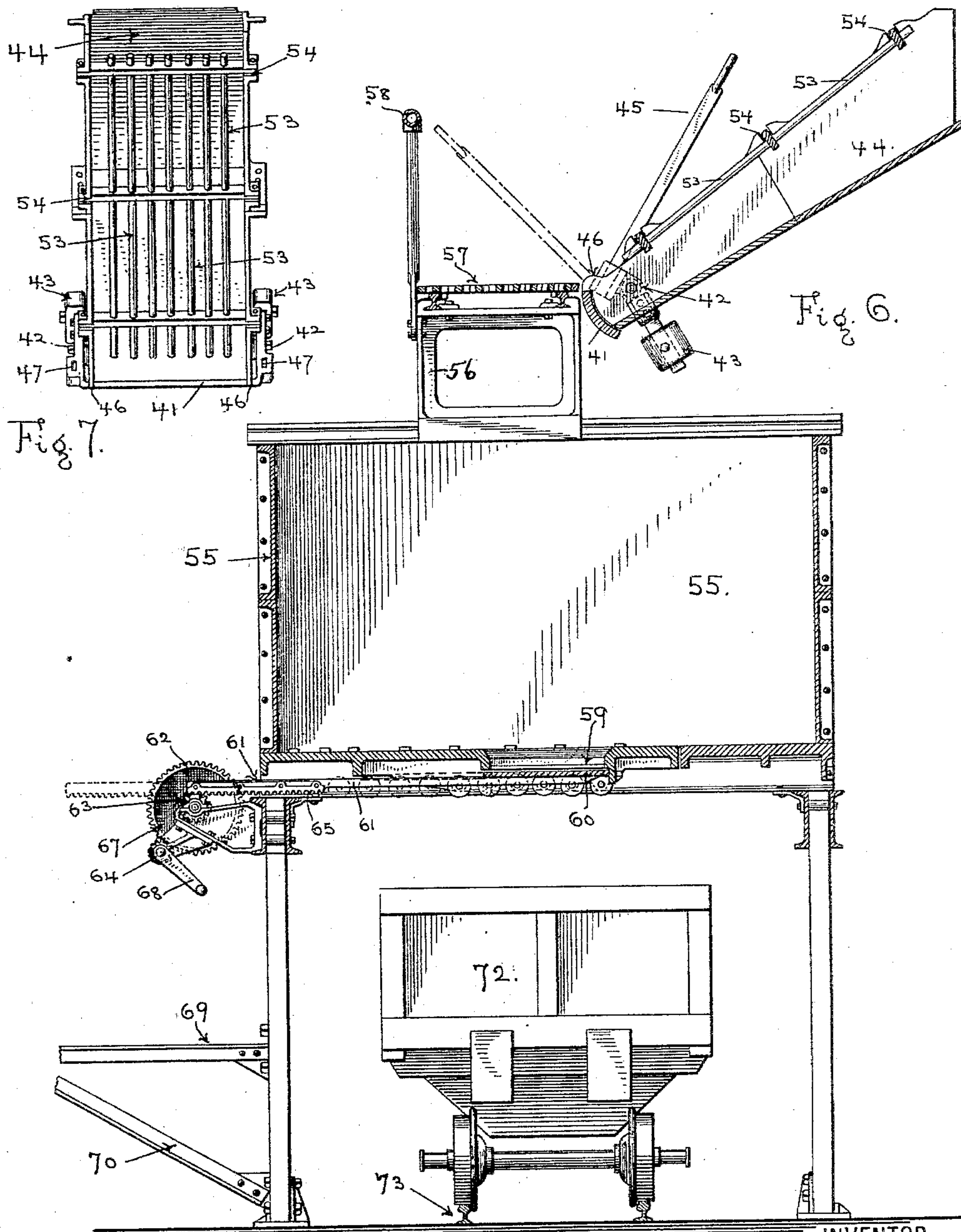
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# UNITED STATES PATENT OFFICE.

HENRY WEHRUM, OF ELMHURST, PENNSYLVANIA, ASSIGNOR TO THE LACK-  
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## FURNACE FOR ROASTING ORES.

SPECIFICATION forming part of Letters Patent No. 597,629, dated January 18, 1898.

Application filed February 17, 1897. Serial No. 623,831. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY WEHRUM, a citizen of the United States, residing at Elmhurst, in the county of Lackawanna, State of Pennsylvania, have invented certain new and useful Improvements in Furnaces for Roasting Ores, of which the following is a full, clear, and exact description.

My invention relates to furnaces for desulfurizing iron ores, and has for its object, primarily, to provide certain improvements in the construction disclosed in an application filed by me the 20th day of April, 1896, and numbered in serial 588,252, said improvements being designed to improve the operation and increase the efficiency of said construction.

Enumerated in detail, said improvements consist, first, in certain novel embodiments in the construction of the gas and air inlets for the combustion-chambers, whereby a perfect means for thoroughly and expeditiously removing any accumulation of dust and dirt is provided without in any way interrupting or interfering with the efficient operation of the device; secondly, in so improving the construction and location of the passages for the incandescent gases into and out of the roasting-pockets that a maximum of efficiency is attained and the ores are subjected to a thorough roasting at all points during their passage through the roasting-pockets; thirdly, in certain improvements in the construction of the spouts and gates for controlling the delivery of ores from the roasting-pockets, whereby an absolutely perfect control may be had over the delivery of the ores from said pockets, said ores being at the same time rapidly cooled, and, fourthly, in certain improvements in the construction of the lower ends of the roasting-pockets, whereby the ores are divided and delivered in small quantities. These objects I accomplish in the manner and by the means hereinafter described and claimed, reference being had to the accompanying drawings, in which—

Figure 1 is an end elevation of a roasting-furnace embodying my improved construction, the same being shown partly in section. Fig. 2 is an enlarged detail vertical sectional view of a portion of said furnace. Fig. 3 is a detail vertical sectional view taken on the

line  $x x$ , Fig. 2, and looking in the direction of the arrow. Fig. 4 is a similar view taken on the line  $y y$ , Fig. 2, and looking in the direction of the arrow. Fig. 5 is a view showing portions of three adjacent roasting-pockets and their accessories, one being an outside view, the second a vertical sectional view through the roasting-pocket, and the third a similar view through the combustion-chamber. Fig. 6 is a detail sectional view of one of the delivery-spouts and its storage-bin, and Fig. 7 a detail top plan view of the lower end of one of the delivery-spouts.

Similar numerals of reference denote corresponding parts in the several views.

In its general features my improved construction embodies the characteristics disclosed in my application above referred to—consisting of two structures 100, each containing a plurality of independent roasting-pockets 1 and their accessories, said structures being placed side by side and with an intervening space that is bridged at the tops of said structures by a platform 40, adapted to receive and store ore delivered thereupon from cars 39, running on the railway 38, said railway being supported by a trestle resting on the piers 37. So, also, with the means for supplying gas to the separate combustion-chambers 2 and for leading away the products of combustion from the separate waste-gas chambers 3, said means consisting of a gas-main 15, running longitudinally of the structures and communicating separately with each combustion-chamber through branch pipes 99 and openings 6, said branch pipes 99 being each provided with a valve 16 for independently controlling or cutting off the supply of gas to each combustion-chamber. A common pipe 13, leading into a stack 14 and communicating with each waste-gas chamber 3 through a branch pipe 12, serves to lead away the products of combustion, it being observed that said branch pipes 12 are valved at 95 to provide for the independent control of the draft from each waste-gas chamber. In a like manner the general features of the roasted-ore-receiving bins 55 and the removal-railway 73 are preserved, said bins being located outside the structures and being formed of metal and having openings



59 in the bottoms thereof, normally closed by sliding doors 60, for permitting the discharge of the ore into the cars 72, running on the railway 73. As a preferred means for operating the sliding doors 60, however, I have adopted for each a bar 61, carrying a rack 65, meshing with a gear-wheel 63, that is mounted on a shaft carrying a toothed wheel 62, that in turn meshes with a smaller toothed wheel 64, operated by a crank 68, a convenient platform 69, supported by bars 70, being provided for the workman to operate the same.

Referring now more particularly to Figs. 2, 3, and 4, it will be seen that the gas from the main 15 is conducted separately into each combustion-chamber 2 through an opening 6 and gas-chamber 7, the latter being located directly beneath its combustion-chamber 2 and having its lower end formed with converging walls 22, coming together at a central opening 23, communicating with the outside and closed by a door 24, having a locking-handle 25. Directly to the rear of each gas-chamber 7 and also beneath its combustion-chamber 2 is an air-chamber 9, an intermediate partition-wall separating the two and both being open at the top to freely communicate with their combustion-chamber. Located transversely across the upper ends of said chambers are a series of refractory girder-bricks 10, which serve to check and break the volume of ascending gas and air and to mix the same. Each air-chamber 9 is provided with air-passages 8, communicating with the outer air and provided with sliding regulating-doors 21, while the base of said chamber slopes, as at 27, from the center toward both sides and communicates with the outside through openings 28, provided with sliding doors 29, said openings 28 being on a horizontal level with the opening 23 from the gas-chamber 7. This construction provides a ready means for removing any accumulation of dust and dirt from said chambers 7 and 9 through the openings 23 and 28 without in any way interfering with the continuous supply of air and gas to the combustion-chamber, and as said chambers 7 and 9 are located directly beneath the combustion-chambers they will also receive all dust and dirt falling into said combustion-chambers, the necessity for a separate means for removing accumulations in the combustion-chambers being thus obviated.

The combustion-chambers 2 are each provided on their interior with a series of short staggered walls 11 for interrupting, breaking up, deflecting, and mixing the currents of gas and air, while communication is had with the outside through openings 30, closed by sliding doors 31. Communication is had with the roasting-pockets 1 through passages 4 and from the roasting-pockets into the waste-gas chambers 3 through passages 5, the lower edges of said passages being inclined downwardly in both directions, whereby the descent of the ores in said pockets is facilitated

and the accumulation of dirt in said openings minimized. In all the above-described respects the construction of the combustion and waste-gas chambers and ore-pockets is substantially similar to that disclosed in my application before mentioned; but in the following respects there are embodied in my present construction certain novel features that I will now describe, viz: The passages 4 and 5 are so arranged as to be staggered with respect to each other, while the passages 5 are locally staggered with respect to each other—that is to say, are arranged in horizontal series in such manner as to be out of line vertically with respect to each other—all as best shown in Fig. 5. By this arrangement I obtain a relative staggering of the passages 4 and 5 and a local staggering of the passages 5, which causes great confusion of the currents of incandescent gases through the ores in the pockets 1, forcing them to react upon each other and preventing the formation of arches in the ores while being roasted. The confusion of the gas-currents also causes a most thorough absorption of the heat by the ores, which results in a quickening of the treatment of the ores and a uniform product.

In the back of the waste-gas chambers 3 are provided doors 32 for the removal of dirt, ashes, &c., and in said doors are provided peep-holes covered by flaps 33, swinging on pins 34, through which the ores may be readily inspected and by their color the proper progress of the roasting determined without the necessity of opening the doors 32. For the purpose of obtaining access to these doors and peep-holes, as well as to the openings 30 in the front of the furnace, I have provided galleries 35 and 36 for the workmen.

I have shown in Figs. 2 and 5 the lower end of each roasting-pocket 1 provided with a central transverse dividing-wall 48, preferably capped with a metallic plate 49, for the purpose of directing the contents of the pocket into two spouts 44, while communication is afforded with the back of the roaster through one or more horizontal tunnels 50 for each roasting-pocket, said tunnels being provided with doors 51. It will readily be understood that by opening or removing said doors 51 a large volume of air may be admitted to each roasting-pocket at its lower end, thereby materially aiding in the desulfurization of the descending ores, as specifically described in my hereinbefore-mentioned application.

Each of the spouts 44 is inclined downwardly and projects for some distance beyond the outside wall of the furnace, the top side of each spout being open and provided with a grating consisting of a series of rods 53, sustained by cross-bars 54, (best seen in Fig. 7,) such construction effectually holding the ores, but permitting free access of air thereto, thus providing for a rapid cooling of the same. It will also be understood that this construction permits access of air to the ores



in the upper ends of said spouts within the furnace, though this supply of air is necessarily limited, owing to the close packing of the ores in said spouts.

At the lower end of each spout I have provided a most effectual means of controlling the discharge of the ores, which consists of a downwardly-opening gate 41, pivoted on the spout at 42 and having attached counterweights 43 and sockets 47 for the reception of removable handles 45. It will be observed by referring to Fig. 6 that said gates 41 are curved in the arc of a circle taken from their pivots 42 and that stops 46 are provided for limiting the upward movement of said gates. This construction provides for a positive and automatic upward closing of said gates and has been found in practice to afford a perfect control over the discharge of the ore, as this discharge can be checked by simply releasing the handle 45, the counterweights instantly forcing the gates to their closed position against the stops 46.

Running longitudinally of the receiving-bins 55 on the outer sides of each structure 100 is a platform 57, supported by framework 56 and provided with a hand-rail 58, which provides a support for the workmen while operating the said gates 41.

From the above description the operation of my improved construction will be understood to be as follows: The ores are dumped upon the platform 40 from the cars 39 and properly sorted and fed into the tops of the roasting-pockets 1 in either or both structures 100, where they are subjected independently in each roasting-pocket to the roasting action of the ignited mixed air and gas from the chambers 7 and 9, the supply of gas to each combustion-chamber being independently controlled by the valves 16 in pipes 99.

The advantages gained by the described relative arrangement of the passages 4 and 5, as well as by the construction of the chambers 7 and 9, have been hereinbefore definitely set forth, while those obtained by the independent control of the draft from each waste-gas chamber 3 and the bottom air-supply to the roasting-pockets through the tunnels 50 have been described and claimed in my application before mentioned. It has been found in practice, moreover, that the condition of the ore during the roasting operation can be best judged from the rear, and by providing the peep-holes in the doors 32 I am enabled to inspect the ore in any roasting-pocket and at any point in its descent without the necessity for opening said doors 32 themselves and thus interfering with the draft.

The advantages of the grated construction of the spouts 44, as well as the construction

and operation of the gates 41, have also been hereinbefore set forth in detail, while the construction and function of the bins 55 and 73 are substantially the same as described in my said application, such differences in detail as exist being adopted merely for convenience in operation, to which no claim is made.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a roasting-furnace, a combustion-chamber, gas and air chambers opening into said combustion-chamber and having inclined lower ends and separate cleaning-openings communicating with said lower ends, substantially as set forth.

2. In a roasting-furnace, a combustion-chamber, a gas-chamber opening thereinto and having its lower end converging downwardly toward its center, an air-chamber also opening into said combustion-chamber and having its lower end diverging from the center toward each side, a vertical longitudinal partition-wall separating said gas and air chambers, and separate cleaning-openings at or near the lower ends of said gas and air chambers and lying in the same horizontal plane, substantially as set forth.

3. In a roasting-furnace, a combustion-chamber, a series of short walls therein one above the other and staggered with respect to each other, a roasting-pocket having combustion-passages thereinto from said combustion-chamber, and a waste-gas chamber having combustion-passages thereinto from said roasting-pocket, the first-named passages being staggered with relation to the second-named passages, and the second-named passages being staggered with relation to each other, substantially as set forth.

4. In a roasting-furnace, a roasting-pocket, a dividing-wall in the base of said pocket forming two delivery-ports, a spout for each port, and two air-tunnels for the admission of air to the roasting-chamber at points near the dividing-wall, at opposite sides thereof, and opposite the origin of said delivery-spouts, substantially as set forth.

5. In a roasting-furnace, a roasting-pocket, a delivery-spout therefor having its projecting portion provided with an open top, a series of longitudinally-arranged bars extending the length of said open top, a downwardly-opening gate for said spout, and means for operating said gate, substantially as set forth.

In witness whereof I have hereunto signed my name this 15th day of February, 1897.

H. WEHRUM.

In presence of—

ALFRED ERNST,  
A. H. LEE.