No. 741,680. PATENTED OCT. 20, 1903.

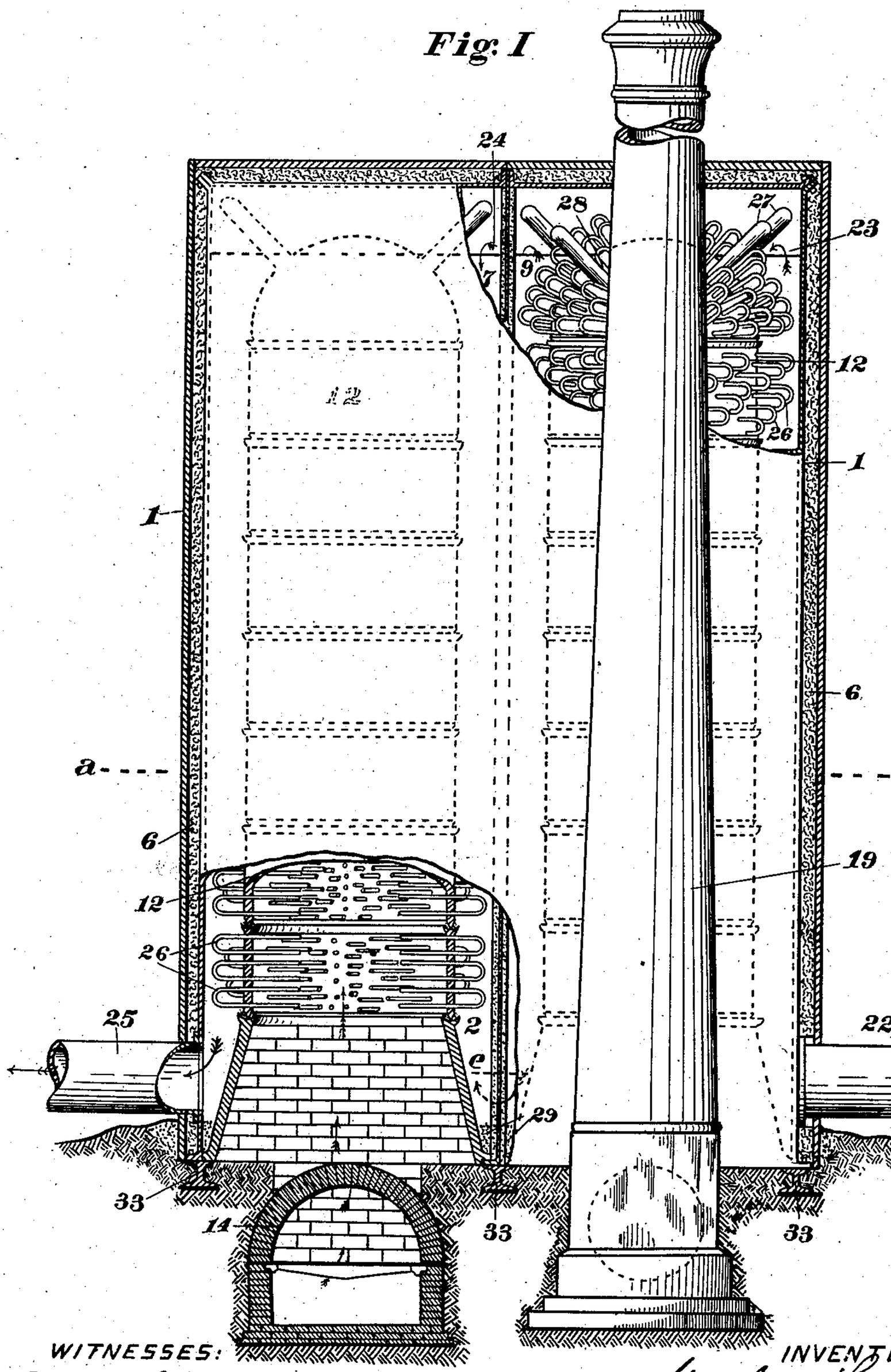
H. LANG.

HOT BLAST STOVE.

APPLICATION FILED MAR. 30, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. I



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NO MODEL. 3 SHEETS—SHEET 2.

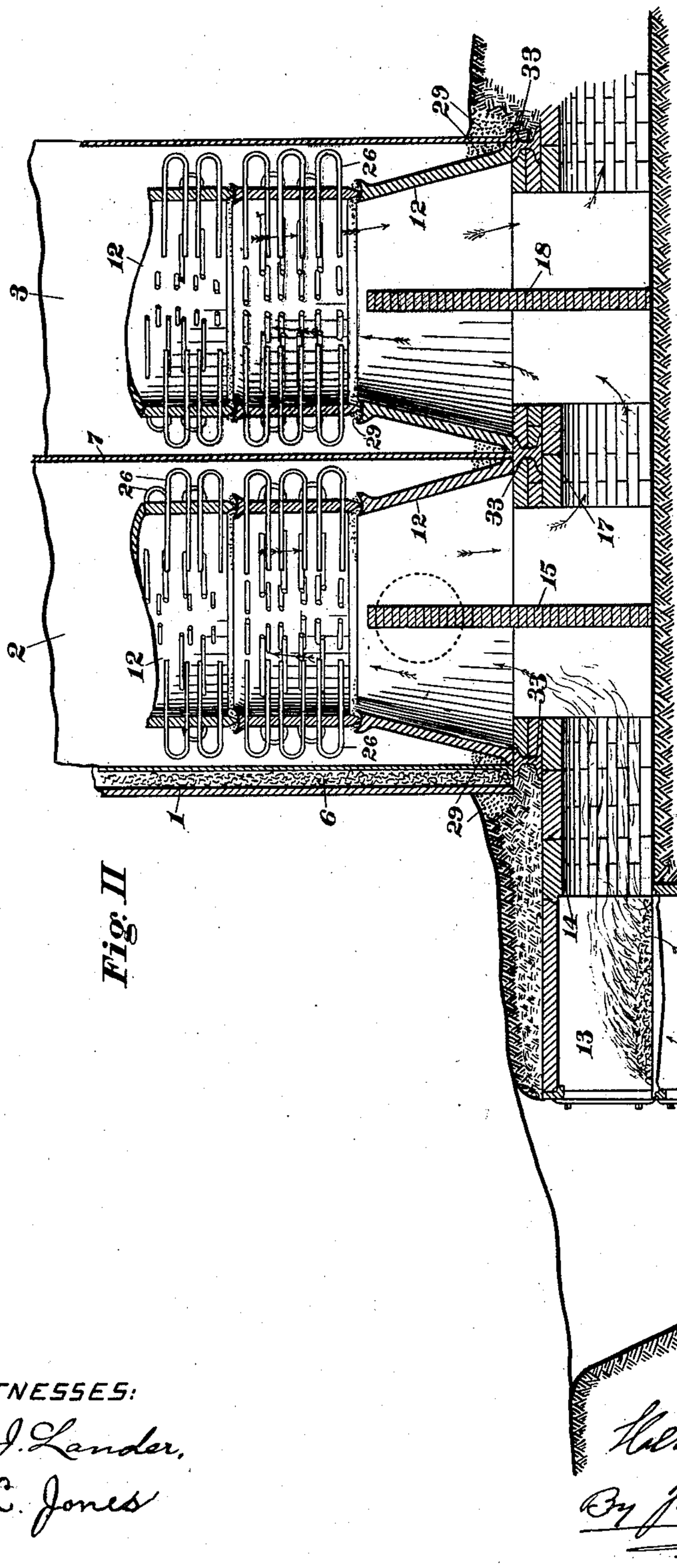

Fig: II

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. III

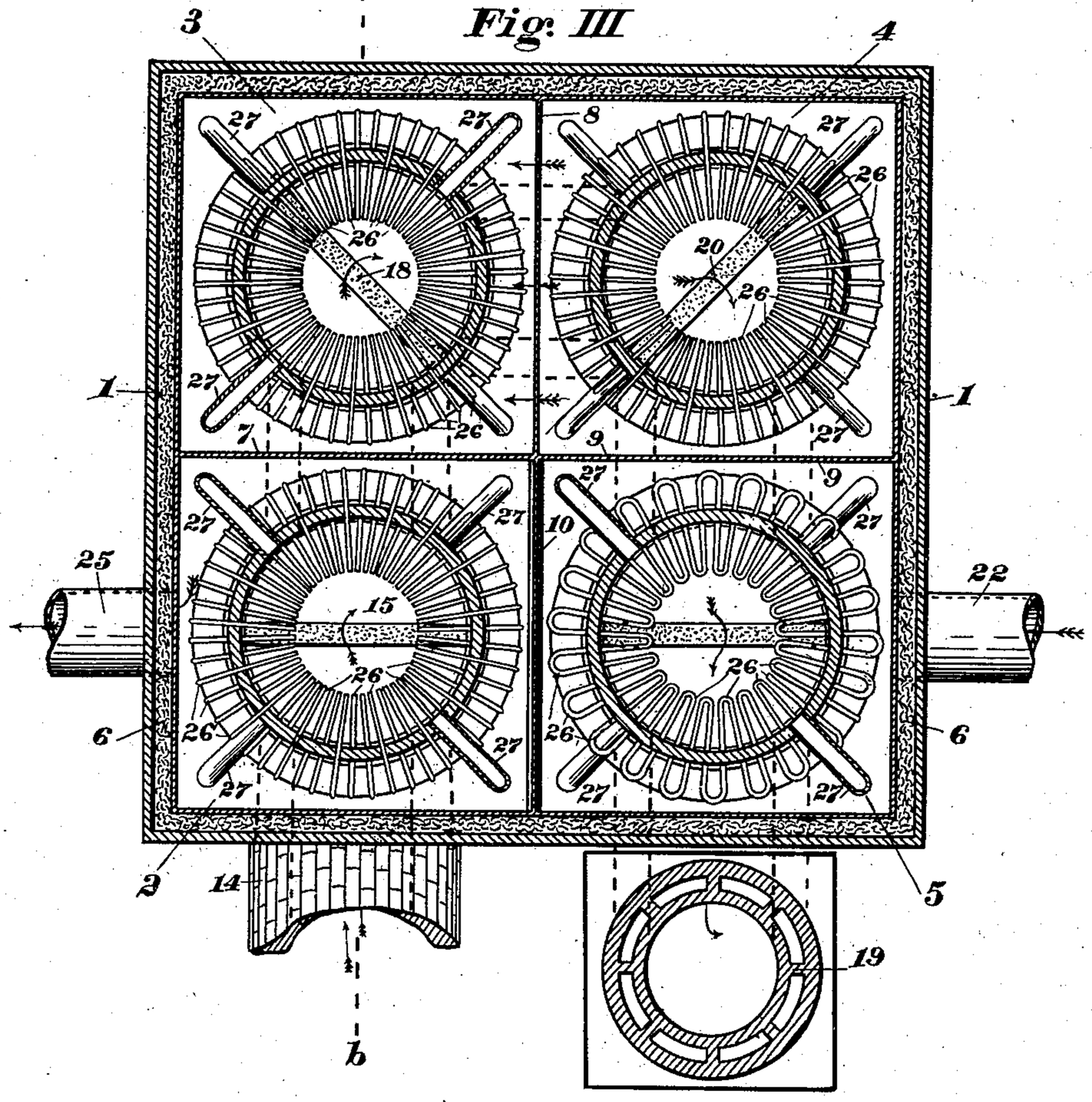
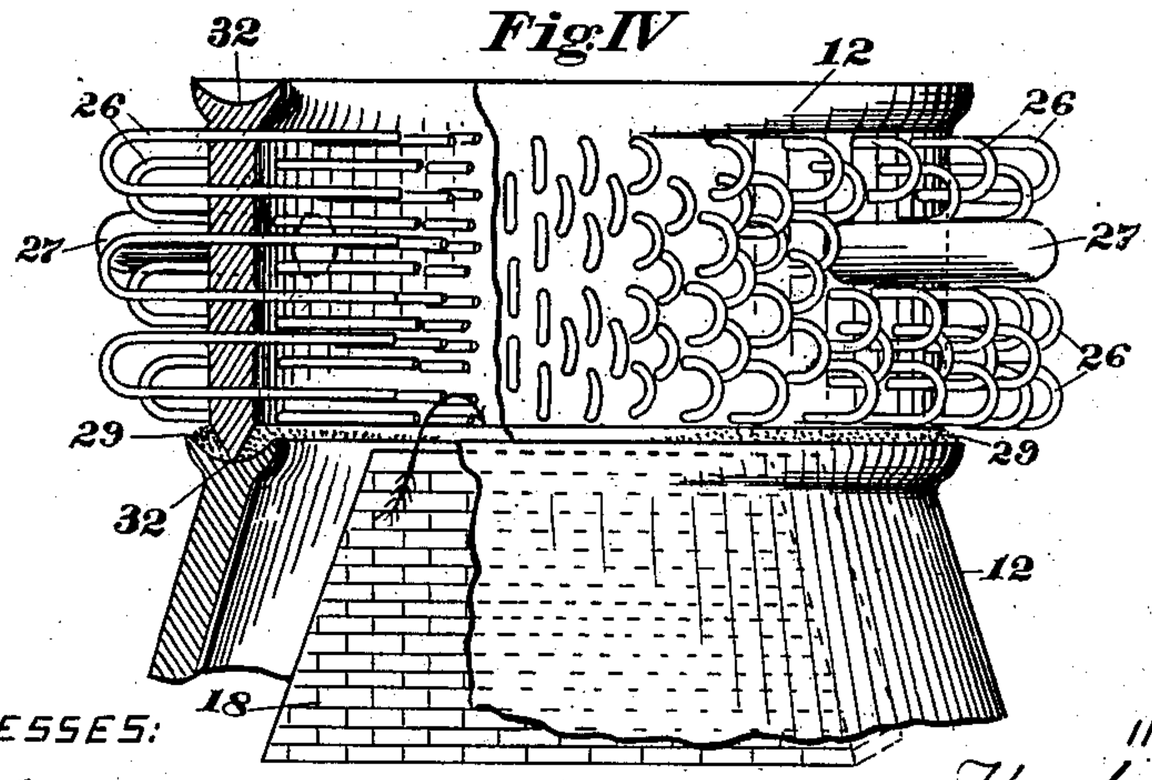


Fig. IV



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UNITED STATES PATENT OFFICE.

HERBERT LANG, OF OAKLAND, CALIFORNIA.

HOT-BLAST STOVE.

SPECIFICATION forming part of Letters Patent No. 741,680, dated October 20, 1903.

Application filed March 30, 1903. Serial No. 150,176. (No model.)

To all whom it may concern:

Be it known that I, HERBERT LANG, a citizen of the United States, residing at Oakland, county of Alameda and State of California, have invented certain new and useful Improvements in Hot-Blast Stoves; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to apparatus for heating air, technically called when employed for metallurgic processes "hot-blast stoves," and to certain useful improvements in such apparatus, hereinafter described in this specification and illustrated in drawings that form a part of the same.

My improvements consist in a series of heating chambers or retorts composed of superimposed cylindrical sections through which the heat passes and from which it is radiated consecutively, these retorts so joined and constructed as to avoid the derangement and expense of maintenance common in such apparatus; also consist in conducting pins, rods, or tubes, or all of these, inserted in the walls of these retorts, placed in the path of the heat therein, and projecting through the walls into the surrounding air to be heated, thereby greatly increasing the transfer of heat and a saving of space accordingly, and further consist in mounting these retorts so that they can expand and contract freely within themselves and without disturbing other structural parts.

Referring to the drawings and manner of constructing the heating apparatus, Figure I is a front elevation, partially in section, showing a heating apparatus of four cells arranged according to my invention. Fig. II is a partial longitudinal section on the line *b b* in Fig. III and at a right angle to Fig. I. Fig. III is a horizontal section through Fig. I on the line *a a;* and Fig. IV is an enlarged broken view of a portion of one of the heating-retorts, showing the manner in which its sections are connected.

The external or containing structure 1 is of rectangular form divided into a plurality of cells 2, 3, 4, and 5, four being shown in the present drawings. The external inclosing walls are preferably made double, with an interposed stratum 6 of refractory and non-conducting material, such as asbestos, to prevent the passage and loss of heat. The interior diaphragms or walls 7, 8, 9, and 10, that form the compartments or cells 2, 3, 4, and 5, can be made of common plates, their purpose being mainly to baffle and direct the heat, as hereinafter explained; but the wall 10 is preferably made thicker and non-conducting to prevent the transfer of heat between the cells 2 and 5, which are the hottest and coolest, respectively. Within said cells 2 3 4 5 are located the heating-retorts 12, arranged in vertical tiers of superimposed sections, one tier in each cell, said sections being unattached, but sealed by means hereinafter described, leaving them free to expand and contract laterally under differences of temperature in the different sections. The retorts 12 are heated by a furnace 13, as shown in Fig. II, the flames and hot gases passing through an archway 14 to the first retort, entering at one side thereof, ascending on one side and descending on the other side of the baffling-wall 15, thence through a second archway 17, and upward into the anterior side of the second retort 12, and downward on the opposite side of the second baffling-wall 18, and so on to the last retort 5, and thence to the chimney 19. The arrows in Fig. II indicate the courses of the flames and hot gases on one side or in one plane, and the plan Fig. III indicates their course in the other plane, the baffling-walls 18 and 20 being set obliquely, as seen in Figs. III and IV, to accommodate the course of the heat in a quadrangular structure such as is shown. This produces in the heating-retorts 12 a descending scale or degree of heat most intense in the first and lowest in the last next to the chimney 19. The course of the air to be heated is preferably the reverse. Entering first the cell 5 through the inlet-way 22, it rises around the heating-retort 12 and passes over the top of the wall 9, as indicated at 23 in Fig. I, and descends to the bottom of the cell 4, then passes under the wall 8, which does not extend to the bottom, but stops at the line *e* in Fig. I, entering the cell 3, and, rising to the top, again passes over the wall 7, as indicated

at 24, down through the cell 2, and to the discharge-way 25. The opposite cycles for the heat and the air to be heated cause progressive rise in temperature of the latter and a more rapid transfer of heat by an assimilation of temperatures that would not take place if the extremes were brought in contact, also maintain a uniformly-ascending scale of heat from the furnace 13 to the cell 5. The transference of heat from the heating-retorts 12 to the air in the cells 2, 3, 4, and 5 is greatly promoted by a series of rods or pins 26, also tubes 27, extending within and without the heating-retorts 12, as shown in Fig. IV, also to a smaller scale in the other views, the hollow members 27 being set in the corners of the cells 2, 3, 4, and 5, as seen in the plan view, Fig. III. These conducting-rods 26 and tubes 27 are preferably cast into the sections that form the walls of the retorts 12. The rods 26 may be of various forms, as indicated in the several cells 2, 3, 4, and 5, the sigmoidal form shown in the cell 5 being preferable in most cases. The heating-retorts 12, being subject to great changes of temperature and subjected to a high degree of heat, are usually the most perishable part of such heating devices, but here are constructed without rigid connections of any kind and have free movement in all directions for expansion and contraction. They are composed of a number of cylindrical sections, as indicated by dotted lines in Fig. I, all uniform except those at the top and bottom, the former being dome shape, as shown at 28, and at the bottom flaring or converging, as seen most clearly in Fig. II. These retorts at the bottom rest on any suitable support, but are not attached thereto, and are free to expand and contract by changes of temperature, a seal of loose sand 29 between the retort and the walls of the cells preventing the escape of air downward and into the retorts.

The cylindrical sections composing the retorts 12 are joined in a similar manner, resting one upon the other, as indicated at 30 in Fig. IV. Each section except the top ones 28 is formed with an indented recess or groove 32 around the top, and at the bottom is of an angular wedge form, as seen in Fig. IV. To form a seal, the grooves 32 are filled with sand or other suitable material that by its mobility permits free lateral expansion and contraction of the sections, but seals the joints against the ingress of air from the cells 2, 3, 4, and 5, where the air is under pressure.

The external structure or housing 1, being subject to pressure from the air contained therein, is attached to beams 33, that are anchored to masonry, and thus resist the lifting strain of the air in the cells 2, 3, 4, and 5.

In operating, air under the required pressure is forced in through the inlet-pipe 22, and after traversing the cells 2, 3, 4, and 5 and being heated is conducted from the discharge-way to the place of application and use.

Having thus described the nature and objects of my invention and the manner of constructing and operating the same, what I claim as new, and desire to secure by Letters Patent, is—

1. In a hot-blast stove or air-heating apparatus, a series of more than two adjacently-placed air-cells in communication alternately at top and bottom, an air-inlet to the first cell, an air-outlet from the last cell, a series of superimposed retort-sections forming a continuous tier in each cell, all in communication at bottom, a heating-furnace, and means for sending the products of combustion of said furnace into and out of all the said retorts in succession, in reverse direction to that of the air-current through the said cells.

2. In a hot-blast stove, a series of air-cells in communication, a tier of retorts in each of said cells, composed of superimposed unattached communicating sections, each section beveled on its lower edge and resting in a shallow annular groove formed in the top of the section beneath, relatively wider than the said beveled edge to afford the requisite play, whereby free lateral expansion and contraction in the separate sections is attained, pulverulent filling in said grooves, and means for sending a heating-current through all of said retorts in succession.

3. A series of air-cells in communication alternately at top and bottom, an air-inlet to the first cell, an air-outlet from the last cell, a series of sectional retorts in tiers, one tier in each air-cell, means to send a current of air through the series of air-cells, and means to send a heating-current into and out of each tier of retorts in succession in reverse direction to that of the current of air through the series of air-cells.

4. A series of heating-retorts placed in communicating chambers or cells and adapted to radiate heat therein, these retorts composed of superimposed sections that fit loosely together, a seal of sand or other like loose material in these joints that permits independent contraction and expansion of each of the sections, and heat-conducting pins or rods through the walls of these sections projecting into the heated interior and outward into the surrounding air to be heated, substantially as specified.

5. A series of heating-retorts through which the flames and hot gases from a furnace pass successively, these retorts set vertically in a like series of communicating air-heating chambers or cells of rectangular form, and hollow heat-conducting flues that project into the corners of the rectangular cells, closed at their outer ends, inserted in the walls of the retorts and open to the interior thereof, substantially as specified.

6. A series of air-cells in communication alternately at top and bottom, an air-inlet to the first cell, an air-outlet from the last cell, a series of sectional retorts in each air-cell, unconnected thereto, means to provide for

free separate lateral expansion and contraction of said retort-sections, with sealed joints, means for sending a current of air through the series of air-cells, and means for sending a heating-current through all of said retorts in succession, in reverse direction to that of the air-current through the series of air-cells.

7. A series of air-cells in communication alternately at top and bottom, an air-inlet to the first cell, an air-outlet from the last cell, a series of retorts in each cell composed of loose superimposed sections, means to provide for free lateral expansion and contraction between said sections, with sealed joints, means for sending a current of air continuously through the series of air-cells from first to last, and means for sending a heating-current into and out of said retorts in succession, in reverse direction to that of the air-current through the series of air-cells.

8. A series of communicating chambers or cells, means to circulate air under pressure through these cells, and a series of heating-retorts disposed centrally therein, the latter provided with heat-conducting pins or rods, fixed in the walls of the heating-retorts and projecting outward and inward from the hot gases in the retorts to the air circulating through the cells, substantially as specified.

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

HERBERT LANG.

Witnesses:
P. W. J. LANDER,
J. C. GARRETT.