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Heating Apparatus.

No. 155,399. Patented Sept. 29, 1874.

Fig. 2

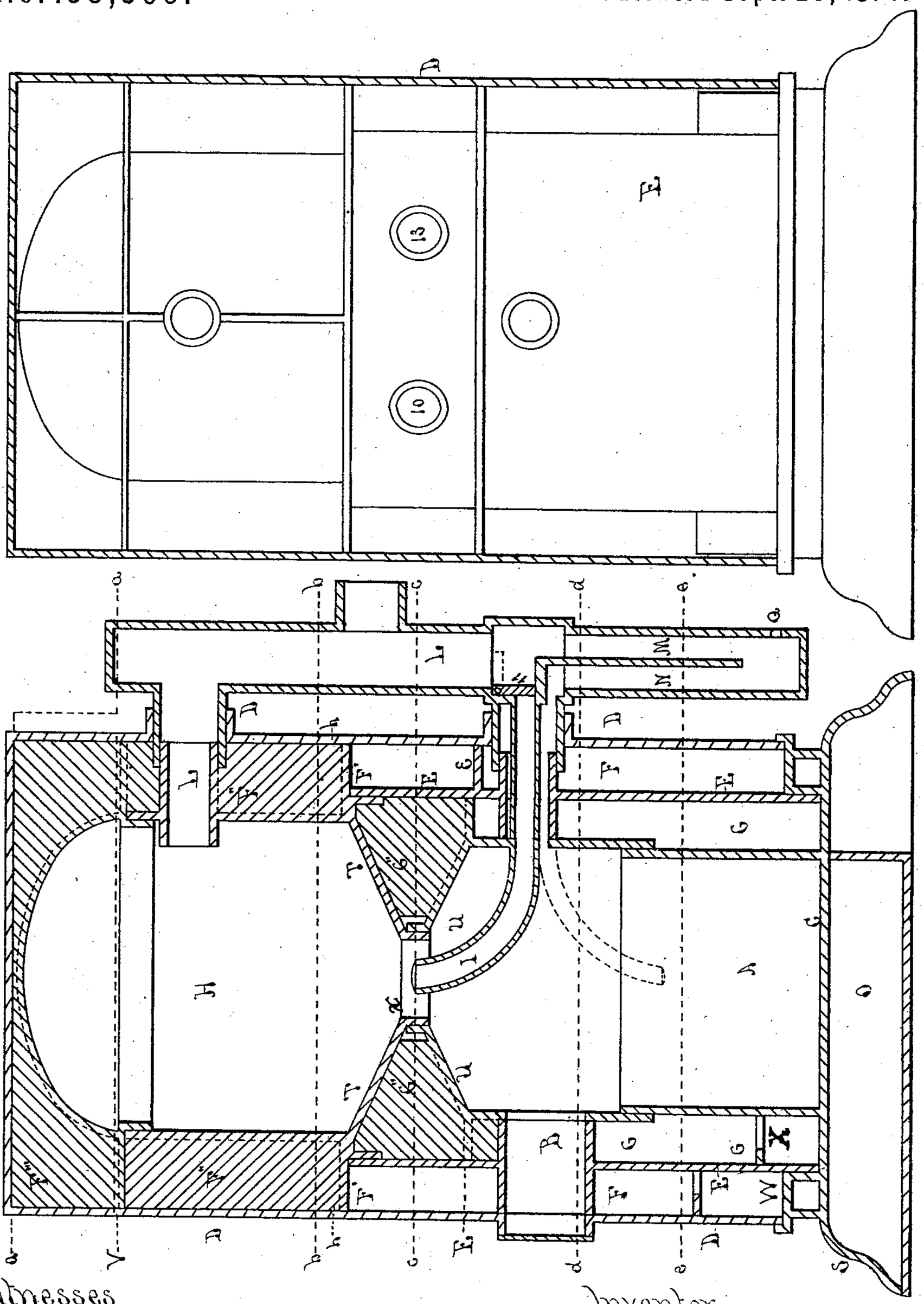

Fig. 1

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Fig. 4

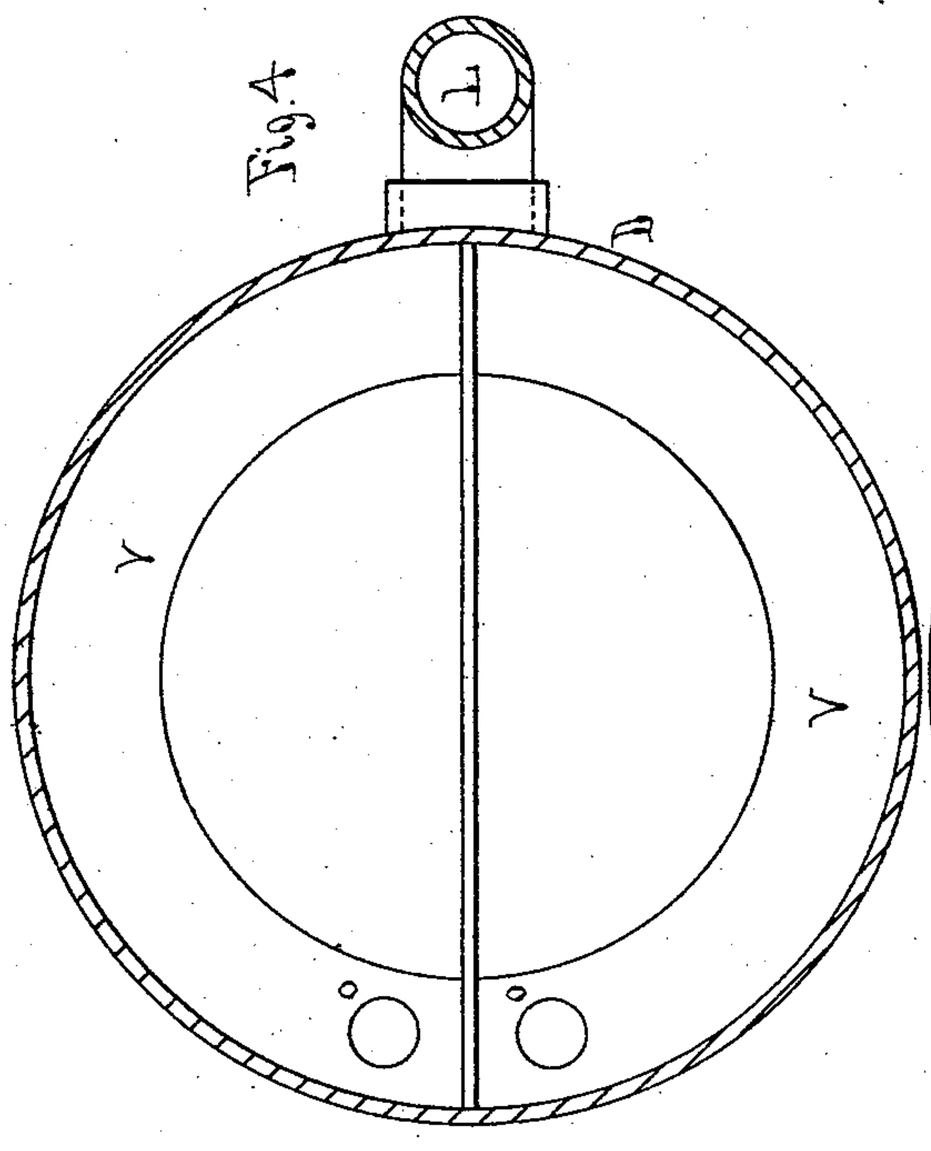

Fig. 5

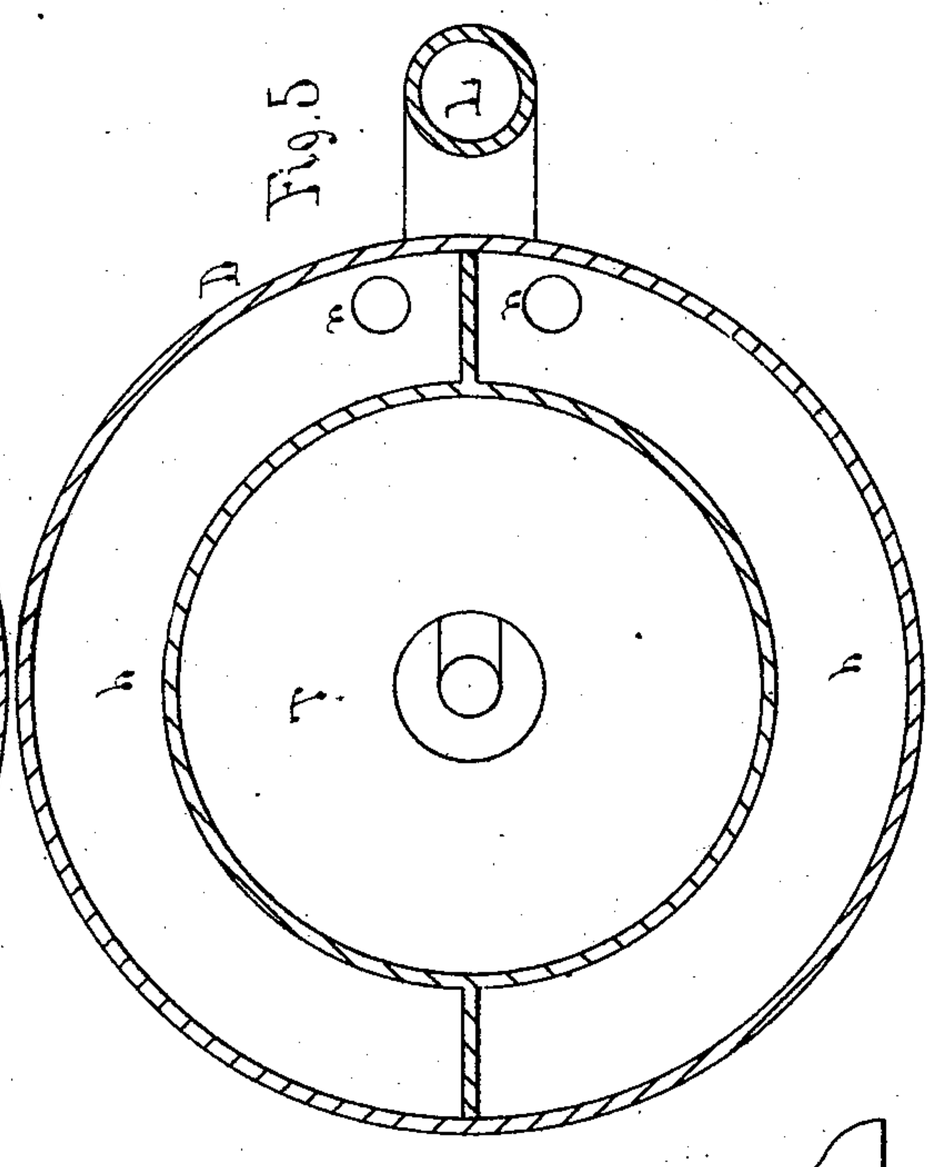

Fig. 3

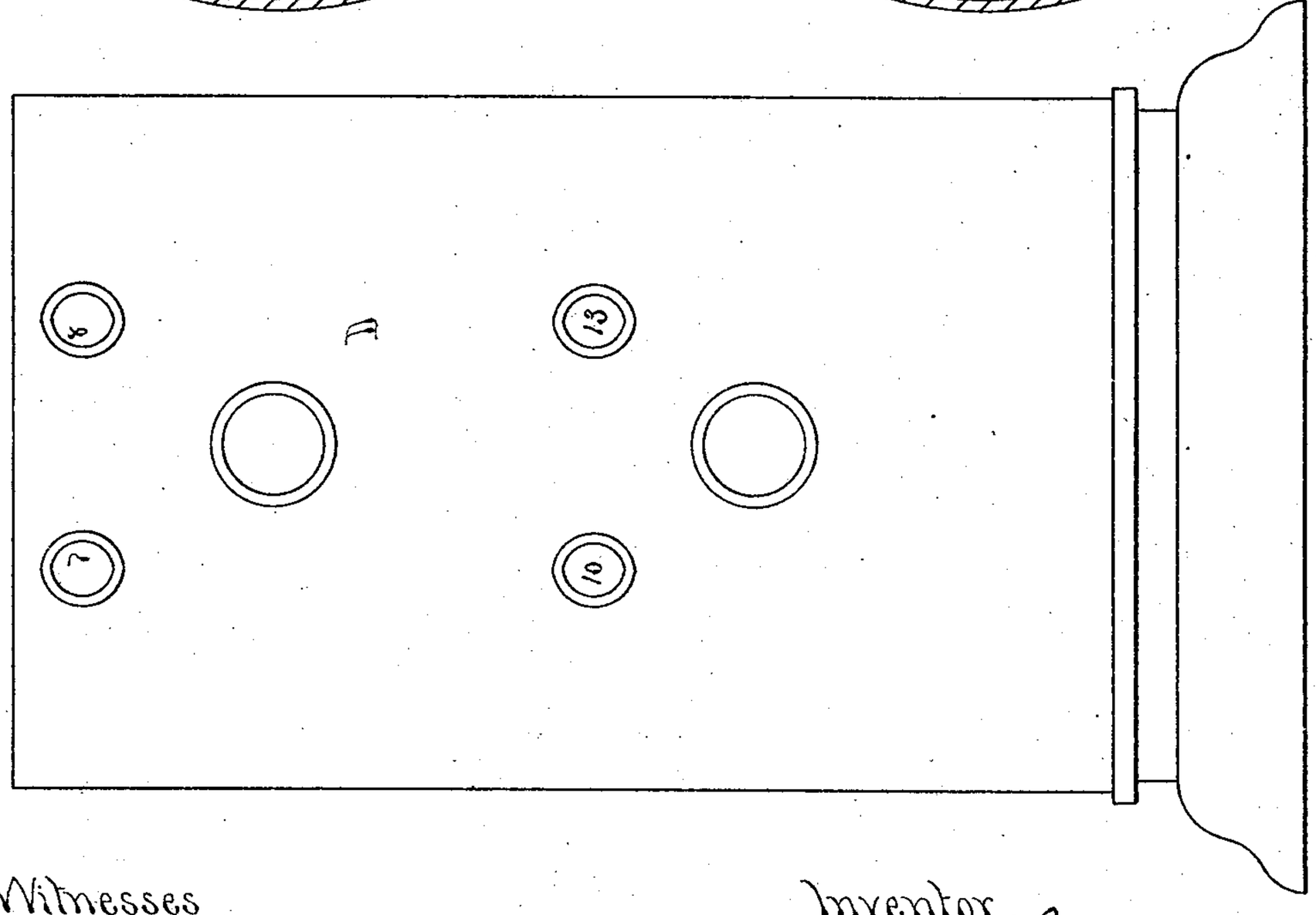

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Fig. 6

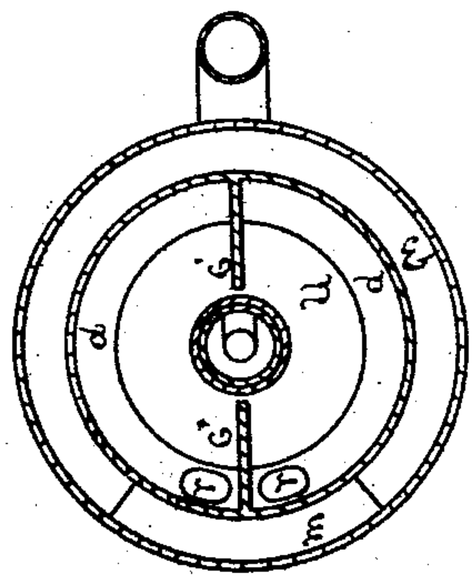


Fig. 7

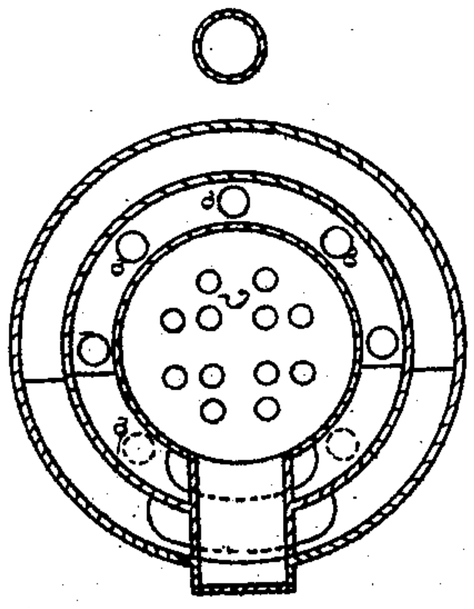


Fig. 8

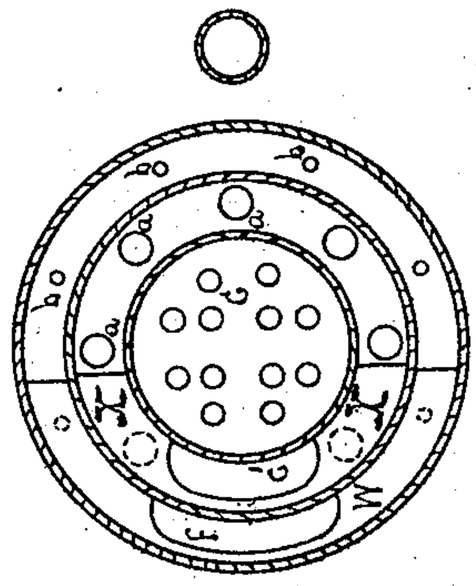
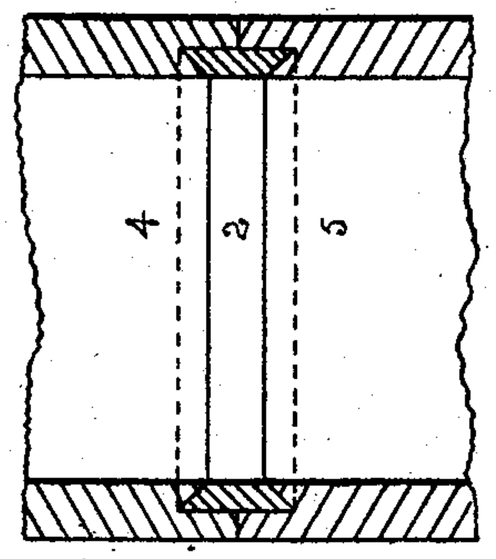


Fig. 9.



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UNITED STATES PATENT OFFICE.

EZRA B. ALDRICH, OF LOWELL, MASSACHUSETTS.

IMPROVEMENT IN HEATING APPARATUS.

Specification forming part of Letters Patent No. **155,399**, dated September 29, 1874; application filed February 18, 1874.

To all whom it may concern:

Be it known that I, EZRA B. ALDRICH, of the city of Lowell, State of Massachusetts, have invented Improvements in Heating Apparatus, of which the following is a specification:

My invention consists, first, in placing over the entrance to the ash-pit, within the vertical walls of the apparatus and above the bottom, a diaphragm constructed to divert the currents of air to be heated, which flow in through the side of the ash-pit, and cause said currents to pass over the wall of the fuel-combustion chamber above the opening of the ash-pit, instead of rising directly upward, as usual, the whole being arranged as hereinafter described; and the object of this part of the invention being to cause the currents of air to flow over and absorb the heat from the walls of the fire-chamber directly over the opening to the ash-pit. Secondly, in a peculiarly-constructed air-heating chamber, extending almost entirely within the vertical cylindrical walls of the fuel-combustion chamber below and the gas-combustion chamber above it, said air-chamber presenting a lower and nearly horizontal wall to the burning fuel below, and another to the burning gas above, and being provided with ingress and egress passages for the air to be heated, which cause it to flow rapidly between and over every part of the intensely-heated walls, and the fuel and gas combustion chambers being connected by a narrow passage through the center of the air-heating chamber, substantially as described hereinafter; the object of this part of the invention being to provide an air-heating chamber within the apparatus which shall present the least possible portion of its area to the outer air, and the greatest portion of its upper and lower horizontally-placed walls to the direct action of the heat. Thirdly, in combining, with the last above-described air-heating chamber, a second cylindrical air-heating-chamber, placed below the first and around the fire-pot, by means of an opening at the top of the second chamber and on the opposite side of the first chamber from its air-egress passages, and letting the air to be heated into the bottom of the second chamber and at the bottom of the apparatus, substantially as hereinafter described; the object of this part of the invention being to partially heat the air in the second chamber below, and also give it a considerable draft in ascending, so as to cause it to flow horizontally over the highly-heated walls of and through the first chamber with considerable rapidity, and thus absorb all the heat, it being necessary to cause the air to flow rapidly to accomplish this purpose. Fourthly, in a series of cylindrical air-heating chambers placed entirely around the fuel and gas combustion chambers, each having its air-ingress passage at the bottom, and its air-egress passage at the top, into the air-chamber above, and on the opposite side of the fuel and gas combustion chambers from the ingress-passage, so that the current of air flowing into each chamber from below must pass entirely around the combustion-chamber before escaping upward, and the current of air must pass several times around the apparatus before escaping from it; the object of this part of the invention being to keep the current of air continually moving in a horizontal and upward direction without forcing it downward, and at the same time cause it to pass over a great extent of the heated walls before it is used. Fifthly, of a heating apparatus with one or more air-heating chambers entirely surrounding its combustion-chamber, and having a current of air rising upward through them, and with one or more air-heating chambers surrounding the first series, and a separate and independent current of air rising upward through the outside air-chambers; the object of this part of the invention being to allow the outside series of air-heating chambers to absorb the caloric passing through the first series, while at the same time the air-currents rise in their natural direction, and no escape of heat and consequent loss is experienced by forcing the air-currents, or either of them, downward against their normal course. Sixthly, in connecting the fuel-combustion chamber and the gas-combustion chamber by a narrow passage for the rising column of gases, and delivering unto the center of the latter a current of air by a pipe or passage extending from the exterior of and near the base of the apparatus; the object of this part of the invention being to

thoroughly intermingle the air and gases to consume the latter in the gas-chamber.

In the drawings, Figure 1 is a central vertical section of the heating apparatus through the fire-door and smoke-pipe. Fig. 2 is a rear-side elevation of the interior cylinder, with vertical central section of the outer case. Fig. 3 is a rear elevation of the apparatus with the smoke-pipe detached. Figs. 4 to 8, inclusive, are cross-sections of Fig. 1—Fig. 4 on line *a a;* Fig. 5 on line *b b;* Fig. 6 on line *c c;* Fig. 7 on line *d d;* Fig. 8 on line *e e.* Fig. 10 is a view of my improved joint.

The different parts are made of cast and wrought iron, fire-brick, masonry, &c., or of any approved materials for the various portions.

The common manner of joining the different segments of the walls of furnaces is to press the edges firmly together upon a thin layer of cement between them, this layer extending through from one surface to the other. But my method is to construct the parts about the joint and seam as shown in Fig. 10, with both a right-angled and acute-angled shoulder upon each, as shown in the parts 4 and 5—that is, I place the edges of the walls together in the ordinary way, but on the inner face of the wall I form a dovetail groove against the seam, so that one-half of the groove shall be in one segment, and one-half in the other, as shown in Fig. 10; and I then fill this groove with a layer of cement. (Shown in the figure at 2.) This makes a joint perfectly and tightly covered, impermeable to gases, and which may be easily cemented anew without disturbing the walls of the apparatus.

Referring now to Fig. 1, O is the base-chamber of my furnace, which may have the usual opening for removing ashes, &c. A is the fire-chamber or interior of the fire-pot, having a grated or perforated bottom, C, and which may be lined with fire-brick. B is the casing of the door or entrance for the fuel from the outside. U is a diaphragm, having somewhat the form of a truncated cone with its base downward, with a narrow aperture at the apex; and T is a somewhat similar diaphragm, having its base upward, with a similar aperture at the inverted apex. These diaphragms are joined closely at their smaller ends, and form a narrow circular passage between the fire-chamber A and the gas-chamber H; and through this aperture, at the junction of the two diaphragms U and T, rise the smoke and gases from the fire-chamber A, and are ignited and consumed in the gas-combustion chamber, and any remainder is carried off through the escape-pipe L, which is connected with a chimney. In the base-plate C (represented in Fig. 8) are perforations *a a* and *b b*, arranged in circles around it, one within the other, for the passage of the air, except over the ash-hole S. The air which rises through a part of the perforations *a a*, under and near the ends of the partial diaphragm X, is carried around in front, and rises, after passing over the part of the surface of the fire-pot beneath the partial diaphragm, through the aperture *c* in the middle of the partial diaphragm X, into the chamber G, between the fire-pot A and wall E. The diaphragm X thus carries the air over a part of the heating-surface of the fire-pot above the opening S not heretofore utilized. After leaving the diaphragm X, this heated air, together with the air coming up through the remainder of the perforations *a a* about the wall of the fire-pot, is forced by the annular diaphragm *d*, Fig. 6, entirely around the wall of the fire-pot, between the walls A and E, and escapes upward through the diaphragm *d* by the passages *r r*. The heated air thus allowed to pass through the apertures *r r* in the annular diaphragm *d* escapes into the chamber G″, situated between the two circular conical diaphragms U and T. The chamber G″ has its upper and lower walls formed of the nearly horizontally-surfaced conical diaphragms U and T, heated intensely by the fire-pot below and the gas-chamber above, and thus exposes to the current of air forced through it a very large heating-surface and the least possible cooling-surface of its vertical wall, and it is entirely divided into two separate and independent chambers by a vertical partition, from which the heated air, having, by the configuration of the diaphragms U and T, been compelled to pass over every part of the walls of the fire-chamber, around and between the diaphragms, and exposed between the highly-heated surfaces of the conical diaphragms, passes into suitable conductors, 10 and 13, and is carried into the apartments to be heated.

Although I have here described but two vertical partitions, it is obvious that there may be a greater number, dividing the space between the diaphragms U and T, acting independently, and so diverting a due proportion of heated air for separate conductors leading from the furnace.

Again, outside the wall E the air is admitted through the perforations *b b*, Fig. 8, into the space F between the walls E and D. A portion of the air so admitted through the perforations *b b* enters beneath and near the ends of the partial diaphragm W, passes beneath the diaphragm and through th aperture *f* in a similar manner to the diaphragm X, and the air ascends about the heated wall E until it reaches the annular diaphragm *e*, Figs. 1 and 6, which passes around between and is secured closely to the walls E and D, and the heated air can only rise through the aperture *m* above the entrance-frame B into a second chamber, F′, inclosed between the walls E and E continued upward. Thence the column of air passes around the furnace between the annular diaphragms *e* and *h* in the space F′, and is permitted to rise through two apertures, *n n*, Fig. 5, in the annular diaphragm *h* on the opposite or rear side of the furnace, into the space F″, which

is inclosed between the heated wall of the gas-combustion chamber H and the continued outer wall D, and is carried around between the diaphragm *h* and the upper circular diaphragm V. This space F″ is divided by two vertical division-walls, one in the front and one in the rear of the furnace, into two separate and independent hot-air chambers, from which the heated air passes through two apertures, *o o*, Fig. 4, in the front part of the diaphragm V, one on each side of the partition in the front of the furnace, into the space F‴ between the upper diaphragm V and the top of the furnace. This space F‴ is also divided by a vertical partition-wall into two separate chambers, corresponding with those below, and the two separate currents of heated air thus made to pass about and over the wall and top of the gas-chamber are conducted away through the hot-air conductors 7 and 8 to the rooms desired to be heated.

I have shown the air thus divided into two separate currents by vertical partitions through the chambers; but there may be more currents, if desired, by making other divisions of the chambers; and my object in thus dividing the currents and the heating-surfaces is that each conductor may be supplied with its proportionate amount of heat in any change of wind or other circumstance. Thus I overcome one of the chief difficulties of ordinary furnaces.

The pipe L has a register or opening, Q, at its lower end for the admission of a current of air. This current of air passes upward through the pipe, which is divided by a vertical partition into two passages, M and N. At a point above the surface of the fuel in the fuel-combustion chamber, the current of air is conducted into the latter through the pipe I, and rises in the center of the gases arising from the burning fuel through the passage *x*, and, becoming heated, is thoroughly intermixed with the gases as they expand in the gas-combustion chamber, and causes their complete combustion in that chamber.

In order to assist in the intermixing of the air with the rising gases, the upper end of the tube I is perforated, so as to divide the air into small jets.

The valve 11 is so hinged at one side within the pipe L at the lower or outer end of the tube I that when it is turned downward by means of an exterior handle or lever it partially or completely closes the entrance to the tube I, and causes the current of cold air to pass on upward past the valve 11 into the smoke-escape and chimney, at the same time cutting off the supply of air to the burning gases through the tube I; and when the valve 11 is turned upward it stops the air-current from entering the smoke-escape and chimney at once, and compels it to enter the tube I, as before described, and it thus serves as a regulator, either to increase or deaden the draft through the fire-pot or the gas-chamber.

By applying my improvements substantially as in the manner described above, I force the currents of air over a larger heating-surface with less loss of heat by radiation than has heretofore been done, and the capacity of the furnace for heating is much increased. This is accomplished, first, by carrying the heated air through the chamber G″ between the conical diaphragms U and T, having the gas-chamber above and the fire-pot below them, while at the same time a great economy of fuel is secured, and the usually troublesome escape of gases into the conductors and into the adjoining rooms is prevented; and, secondly, I effect these objects by directing the currents of air, as before described, by means of diaphragms Z, that they pass completely over and between the heating-surfaces, and by providing separate hot-air chambers for the several conductors, and by furnishing sufficient and proper proportions of air to the burning gases.

I claim as new, and as my invention, the following:

1. The partial diaphragm X, placed in the cylindrical air-chamber G over the opening S, and provided with the single upper central escape-passage *c*, combined with the base C, provided with the induct-passages *a a* beneath the diaphragm, substantially as described.

2. The air-heating chamber G″, projecting within the vertical walls of the fuel-combustion chamber below and the gas-combustion chamber above it, and provided with air supply and escape passages *r r* and 10 13, and having the connecting-passage from the fire-chamber to the gas-chamber passing through it, substantially as described.

3. The combination of the air-heating chamber G″, projecting within the vertical walls of the fire-chamber below and the gas-chamber above, as described, with the lower air-heating chamber G, by means of the passages *r r*, placed with reference to the escape-passages 10 13, substantially as described.

4. The series of two or more cylindrical air-heating chambers, F F′, &c., placed one over the other, and inclosing the combustion-chambers A H, and combined by opposite ingress air-passages *m* and egress-passages *n n*, substantially as described.

5. In a heating apparatus, the internal series of cylindrical air-heating chambers G and G″, one over the other, around the fuel-combustion chamber, combined with a second and independent series of cylindrical air-heating chambers, F F′, &c., surrounding the first, constructed and operating substantially as described.

6. The combination of the fuel-combustion chamber A and the gas-combustion chamber H, connected by a narrow throat or passage, *x*, with the air-delivery tube I, supplying air in the center of the ascending column of gases for their combustion, substantially as described.

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