

No. 740,743.

PATENTED OCT. 6, 1903.

R. W. CAVENAUUGH.  
SMOKE PREVENTER FURNACE.

APPLICATION FILED APR. 7, 1900. RENEWED MAR. 7, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



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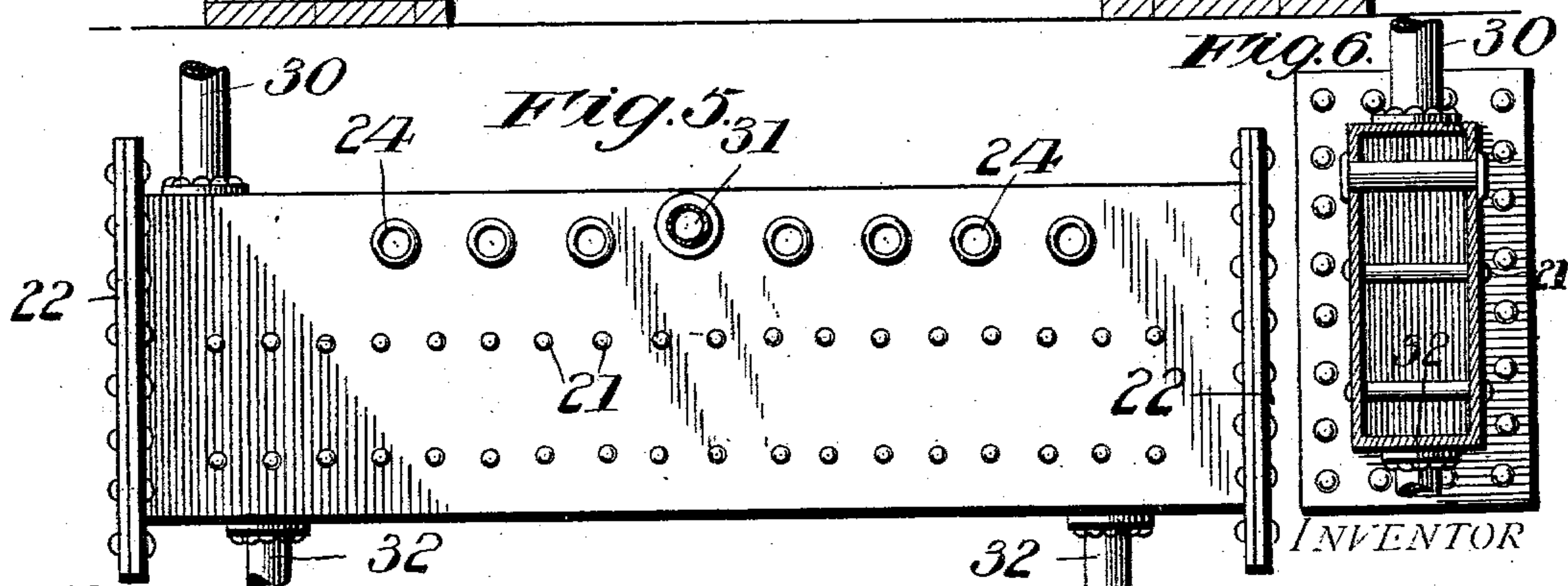
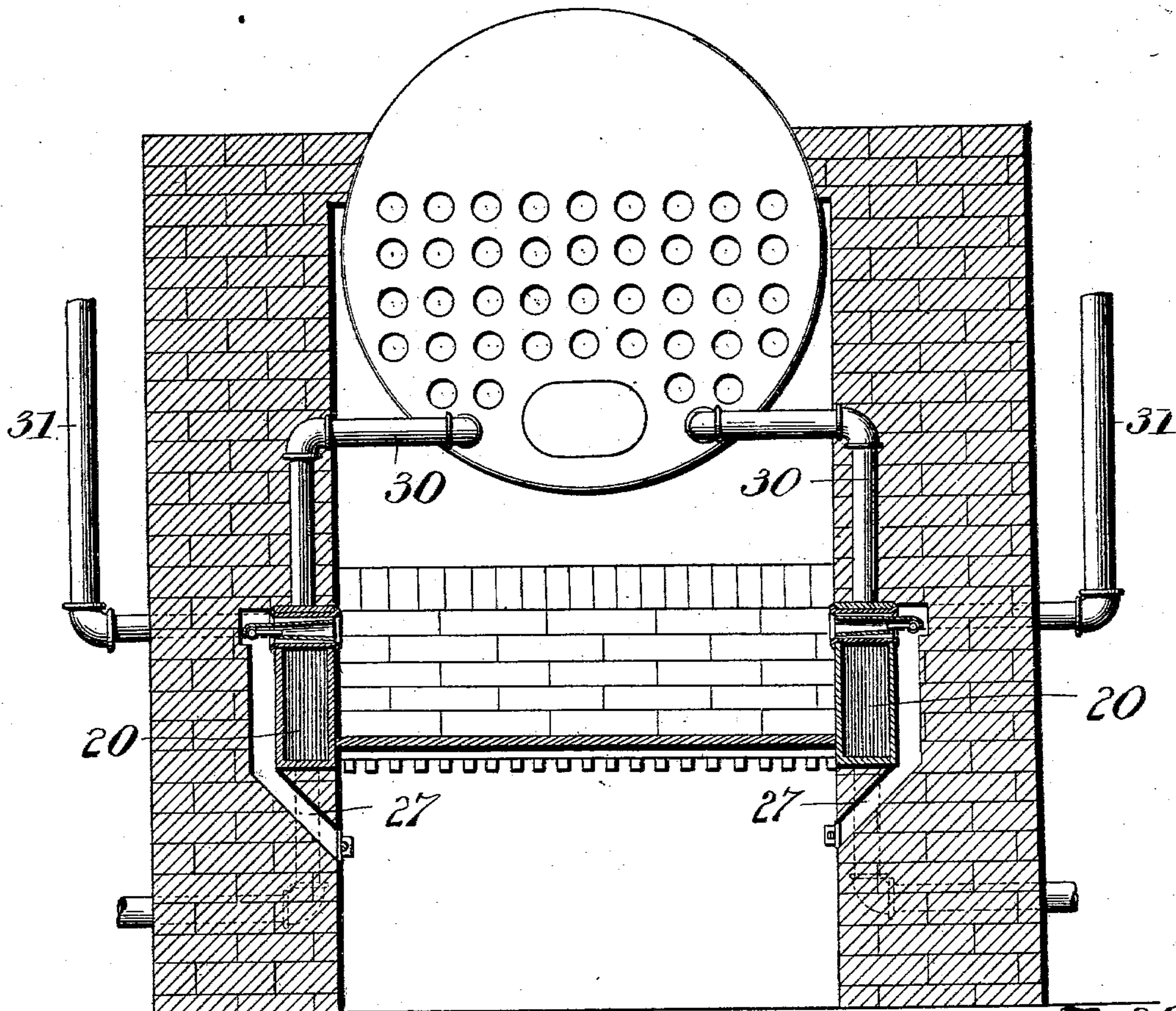
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3 SHEETS—SHEET 2.

*Fig. 2.*



WITNESSES:

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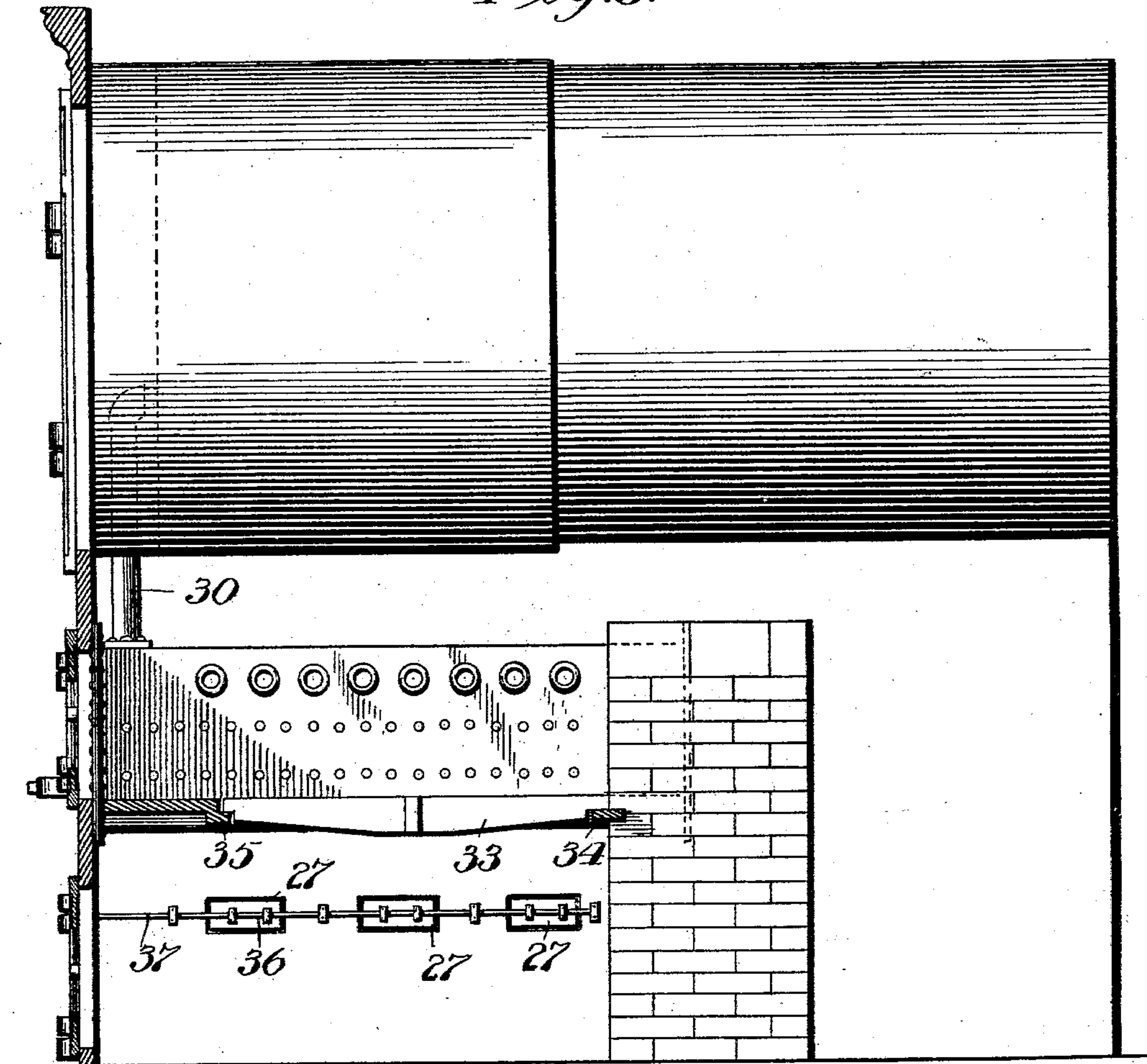
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3 SHEETS—SHEET 3.

*Fig. 3.*



WITNESSES:

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# UNITED STATES PATENT OFFICE.

RALPH WAGGETT CAVENAUGH, OF ST. PAUL, MINNESOTA.

## SMOKE-PREVENTER FURNACE.

SPECIFICATION forming part of Letters Patent No. 740,743, dated October 6, 1903.

Application filed April 7, 1900. Renewed March 7, 1903. Serial No. 146,756. (No model.)

*To all whom it may concern:*

Be it known that I, RALPH WAGGETT CAVENAUGH, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Smoke-Preventer Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to devices designed to create a complete combustion of fuel, and thereby prevent the formation of smoke in boiler-furnaces of various kinds.

The invention has for its object to provide an improved construction of fire-box and also improved means for injecting steam over the top of the fuel in the fire-box along with a proper injection or supply of air thereto.

It has further for its object to provide for the automatic supply of heated air to the fuel of the fire-box along with steam injected into the box, the construction being such that as the steam is automatically injected into the fire-box heated air is at the same time automatically drawn from beneath the fire-box and injected over the body of the fuel in the fire-box, such supply of steam and air being automatically cut off, so that after the fresh fuel has been coked the supply of heated air will be cut off from above the fuel and will be caused to pass up through the grate-bars and through the body of the fuel from beneath the fire-grate.

The purposes of the invention are to supply at the proper time the requisite amount of steam and heated air to the fresh fuel and after the fuel has been coked to cut off the supply of steam and air from above the fuel and to direct the air up through the body of the fuel from beneath the fire-grate and also to prolong the life of the fire-box.

To the accomplishment of the foregoing and such other objects as may hereinafter appear the invention consists in the construction and also in the combination of parts hereinafter particularly described and then sought to be clearly defined by the claims,

reference being had to the accompanying drawings, forming a part hereof, and in which—

Figure 1 is a front elevation of a boiler-furnace with my invention applied thereto. Fig. 2 is a front elevation with the front plate of the furnace removed and illustrating the fire-box in section. Fig. 3 is a longitudinal sectional elevation through the furnace. Fig. 4 is a detail section, on an enlarged scale, through one side of the fire-box and steam and air injector. Fig. 5 is a detail side elevation of one side of the fire-box, and Fig. 6 is a vertical section through the same.

In the drawings, the numeral 1 designates the masonry part of the furnace; 2, the front or face plate; 3, the doors in front of the tubular boiler; 4, the door to feed the fuel to the fire-box, and 5 the door to the ash-pit.

The numeral 6 designates a steam-pipe leading from the steam-dome of the furnace or other source of steam-supply and delivering steam through the pipe 7 and its branches 8 to the steam-pipes 9, extending along the opposite sides of the fire-box, so as to inject steam over the bed of fuel. The supply-pipe 6 is provided at the point 10 with a valve, which is connected by rod 11 with the piston in a water-cylinder 12, to which water is supplied from a city main or other source through the pipe 13, which at the point 14 is provided with a valve actuated through a rod 15, which has a flap 16 in the line of movement of the door 4, so that when the door is opened the valve will be opened to admit water through the pipe 13 into the cylinder 12, beneath the piston therein, said pipe 13 also being provided with a valve 15, which will control the overflow of water from the cylinder 12, and thus regulate the gradual cutting off of the steam by the valve at 10 as the piston-rod descends, the escape of water from the pipe 13 being received by the pipe 16, which leads to a sewer or other point of discharge.

The numeral 17 designates a lubricator, and 18 a steam-trap connected by the pipe 19 to the steam-supply pipe 6.

The several parts so far described may in details of construction be in accordance with Letters Patent granted to me by the United States November 16, 1897, No. 593,565, or of any other approved type of construction.



Under the present invention I form the opposite sides or walls 20 of the fire-box of metal, so as to form hollow walls, each wall being formed of metallic plates, which may be stayed  
 5 by any number of stay-bolts 21, said walls at opposite ends being formed with the heads 22, which extend beyond the walls of the chamber, so that the projecting parts may fit into the brickwork of the furnace and also bear against  
 10 the front of the furnace, as illustrated in Fig. 3, the front heads of these chambers being formed with openings covered by the caps 23, so as to permit access with the interior of the hollow walls for the purpose of cleaning out the  
 15 same. Each wall has extending transversely through its upper portion any desired number of tubes or thimbles 24, whose ends may be upset against the outer faces of the walls, which tubes or thimbles not only serve to stay  
 20 the walls, but also to receive the steam and air mixing tubes 25. These mixing-tubes open into the fire-box on its opposite sides and at their outer ends receive the steam-nipples 26, leading from the steam-pipes 9,  
 25 and by which steam is injected through the mixing-tubes into the fire-box. The rear ends of the mixing-tubes 25 are open, and they communicate with the flues or air-channels 27, which lead from the ash-pit below the  
 30 fire-grate, so that as steam is injected into the mixing-tubes air is sucked from beneath the fire-grate and into the mixing-tubes, where the steam and air combine and are impelled by the steam-jets through the mixing-tubes  
 35 into the fire-box. The mixing-tubes 25 are conical in form and the space between them and the tubes or thimbles 24 is filled or packed with asbestos 28, which protects the parts against intense heat and serves to insure close  
 40 joints between the parts. This packing also serves to prevent the mixing-tubes from working their way out at the rear of the fire-box, and the tubes are also formed with bent or overhanging ends 29, which extend over the  
 45 steam-pipes 9, which overhanging parts will prevent the mixing-tubes from working inwardly toward the fire-box.

Each of the hollow walls 20 connects through a pipe 30 with the tubular boiler below the  
 50 water-line, so that the hollow walls will be supplied with water from the boiler, and from each hollow wall extends another pipe 31, which will also lead to the boiler. Each hollow wall will also be provided with one or  
 55 more blow-off pipes 32, which may be made to lead to the outside of the masonry of the furnace.

The numeral 33 designates the fire-grate, which at the bridge-wall end rests upon a ledge  
 60 34 and at the opposite end upon a ledge 35.

The air flues or channels 27 where they open into the fire-pit below the grate are provided with dampers or valves 36, mounted upon rods 37, journaled in suitable bearings and extending  
 65 through the front of the furnace, where they are provided with cranks 38, connected together by a rod 39, and from said rod or one

of the cranks a chain or wire rope 40 passes around a sheave 41 and is connected with the piston of the water-cylinder 12 through the  
 70 instrumentality of a rod 42, extending from the piston through the lower end of the cylinder, which rod may have weights 43 suspended from its lower end, the wire rope or chain 40 being illustrated in the drawings as  
 75 connected at the lower end of the weights, thus connecting the chain with the rod, which extends from the piston and through the lower end of the cylinder 12. It will be observed that by this arrangement when the piston is  
 80 raised by the actuating agent admitted to the cylinder, so as to open the steam-valve for admitting steam above the fuel in the fire-box, at the same time the rope or chain 40 is pulled so as to open the dampers or valves 36,  
 85 thus admitting warm air to the flues or channels 27, which air is sucked by the steam-jets and impelled along with the steam through the mixing-tubes 25 into the fire-box above the fuel, and, further, that as the steam is gradually shut off by the piston and the cylinder 12 moving downward the dampers or valves 36 are gradually closed. By this arrangement steam and warm air are admitted to the fire-box after each fresh charge of fuel is supplied  
 90 and until the fuel is coked and that after that takes place both the steam and air are shut off from above the fuel, the valves or dampers 36 when closed preventing the air from being sucked from the fire-pit and up through the  
 95 flues or channels 27, and hence when the air is shut off from those channels it must pass up through the body of the fuel from the fire-pit. This produces the best results and the most intense heat and effectually prevents the  
 100 formation of smoke.

I have illustrated and described the construction and arrangement of parts well adapted to effect the operation described, but changes can be made in the details of construction and arrangement so as to obtain  
 110 the same result and without departing from the scope of this part of my invention.

By constructing the fire-box with hollow walls formed as described the life of the fire-box is materially prolonged and the efficiency and durability of a smoke-preventer furnace materially increased.

Having described my invention and set forth its merits, what I claim is—  
 120

1. In a smoke-preventer furnace, the combination of the fire-box having hollow walls set into the brickwork of the furnace and having tubes extending through the same which are open at both ends, pipes connecting the interior of said walls with the water-space of the boiler, air channels or flues leading from the fire-pit and in communication with the fire-box through said tubes, and steam-injecting nozzles opening into said  
 125 tubes at the junction of the same with the upper ends of the air-channels, substantially as described.

2. In a smoke-preventer furnace, the com-



5 combination with the fire-box having hollow walls in communication with the water-space of the boiler, said hollow walls having tubes extending transversely to the same, a steam and air mixing tube in each of the tubes of the hollow walls, said mixing-tubes being open at opposite ends, a steam-supply pipe having steam-jets opening into said mixing-tubes, and air channels or flues leading from the fire-pit and communicating with the mixing-tubes at the end where the steam is injected into the same, substantially as described.

3. In a smoke-preventer furnace, the combination of the fire-box having hollow walls provided with pipes communicating with the boiler and having blow-off pipes, said hollow walls having tubes extending transversely through the same, steam and air mixing tubes lying within said transverse tubes of the hollow walls, steam-supply pipes having steam-jets opening into the mixing-tubes, and air flues or channels leading from the ash-pit and communicating with the mixing-tubes, substantially as described.

4. In a smoke-preventer furnace, the combination of the fire-box having hollow walls provided with pipes communicating with the boiler, said hollow walls having tubes extending transversely through the same, steam and air mixing tubes lying within said transverse tubes of the hollow walls, said mixing-tubes having depending overhanging parts at their rear, a packing between said mixing-tubes and the transverse of the hollow walls, steam-supply pipes beneath the overhanging parts of the mixing-tubes and having steam-jets opening into said tubes, and air flues or channels leading from the ash-pit and communicating with the mixing-tubes, substantially as described.

5. In a smoke-preventer furnace, the combination with the fire-box and ash-pit, of an air-flue in the wall of the fire-box and in communication at its upper end with the fire-box and at its lower end with the ash-pit and closed to communication with said parts at other points whereby at certain periods there may be an uninterrupted passage of warm air from the

ash-pit through said flue to the upper part of the fire-box unaffected by the opening of the furnace-door, a valve-controlled steam-supply pipe entering the upper end of said flue for creating a suction in said flue from the ash-pit and impelling warm air drawn from the fire-box, a damper to the air-flue, a pressure-cylinder having a connection with said damper and with the valve of the steam-supply pipe and provided with an inlet-valve operatively connected with the furnace-door and having an escape for the pressure agent, whereby as the furnace-door is opened the pressure agent is admitted to the pressure-cylinder and the steam-supply-pipe valve and damper to the air-flue are opened to supply steam and warm air to the fuel, and as the door is closed, the supply of the pressure agent is cut off and the agent in the cylinder escapes therefrom and the steam-supply valve and damper to the air-flue gradually closed, substantially as described.

6. In a smoke-preventer furnace, the combination with the fire-box and ash-pit, of air-flues formed in two walls of the fire-box and in communication at their upper ends with the fire-box and at their lower ends with the ash-pit, a valve-controlled steam-supply pipe having parts thereof entering the upper ends of said air-flues, dampers to said air-flues, a pressure-cylinder provided with a piston having one part of its rod extending through one head of the cylinder and connected with the steam-supply-pipe valve and another part extended through the other head of said cylinder and connected with the dampers to the air-flues, an escape-pipe leading from the pressure-cylinder, and an inlet-pipe for the pressure agent having a valve operatively connected with the furnace-door, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

RALPH WAGGETT CAVENAUGH.

Witnesses:

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ROBT. PARKHURST.