

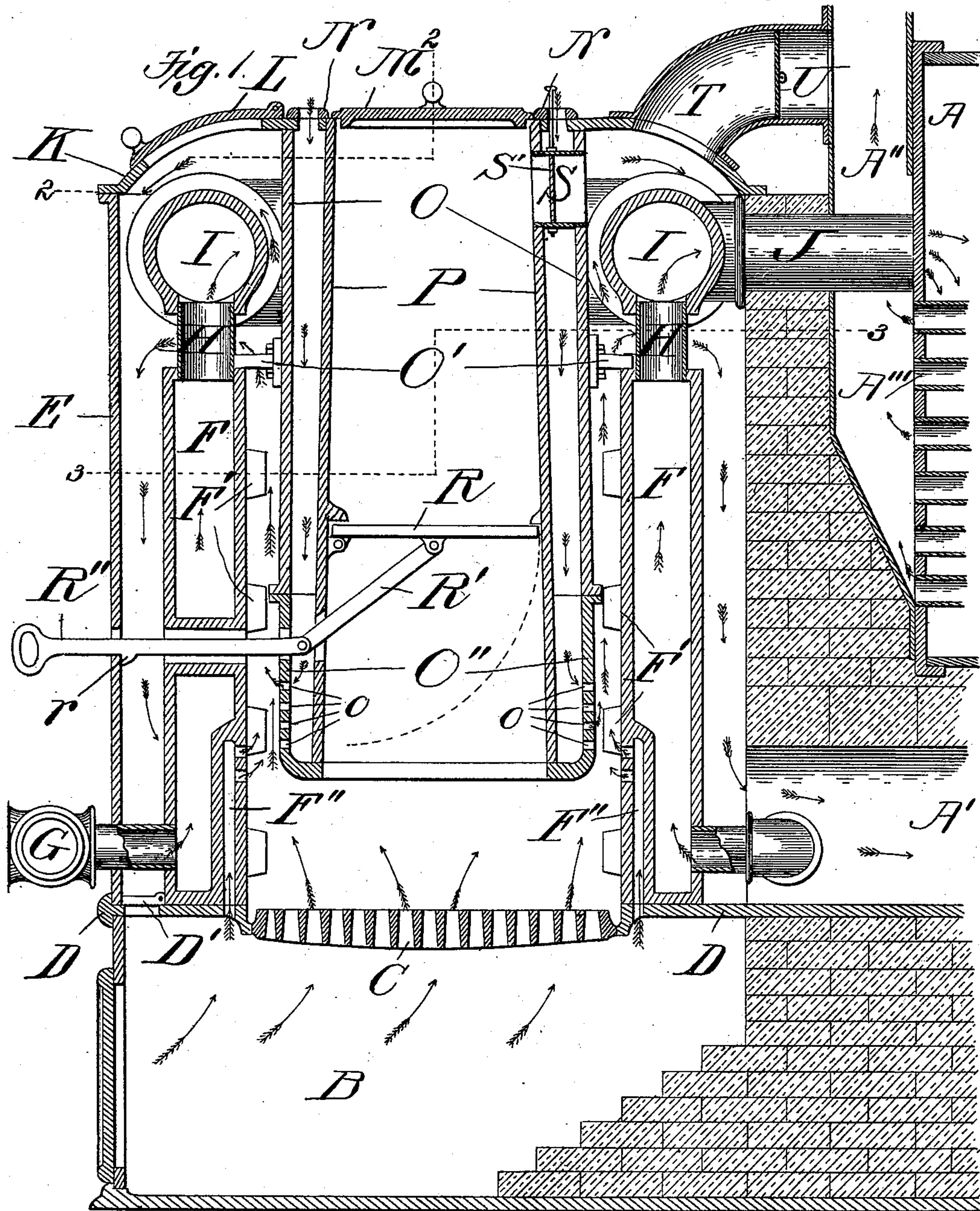
(No Model.)

2 Sheets—Sheet 1.

R. H. LAIRD.
WATER HEATER.

No. 539,918.

Patented May 28, 1895.



Witnesses
J. R. Cornwall
Hugh V. Wagner.

Inventor
Robert H. Laird.

by Paul Bakewell
his atty.

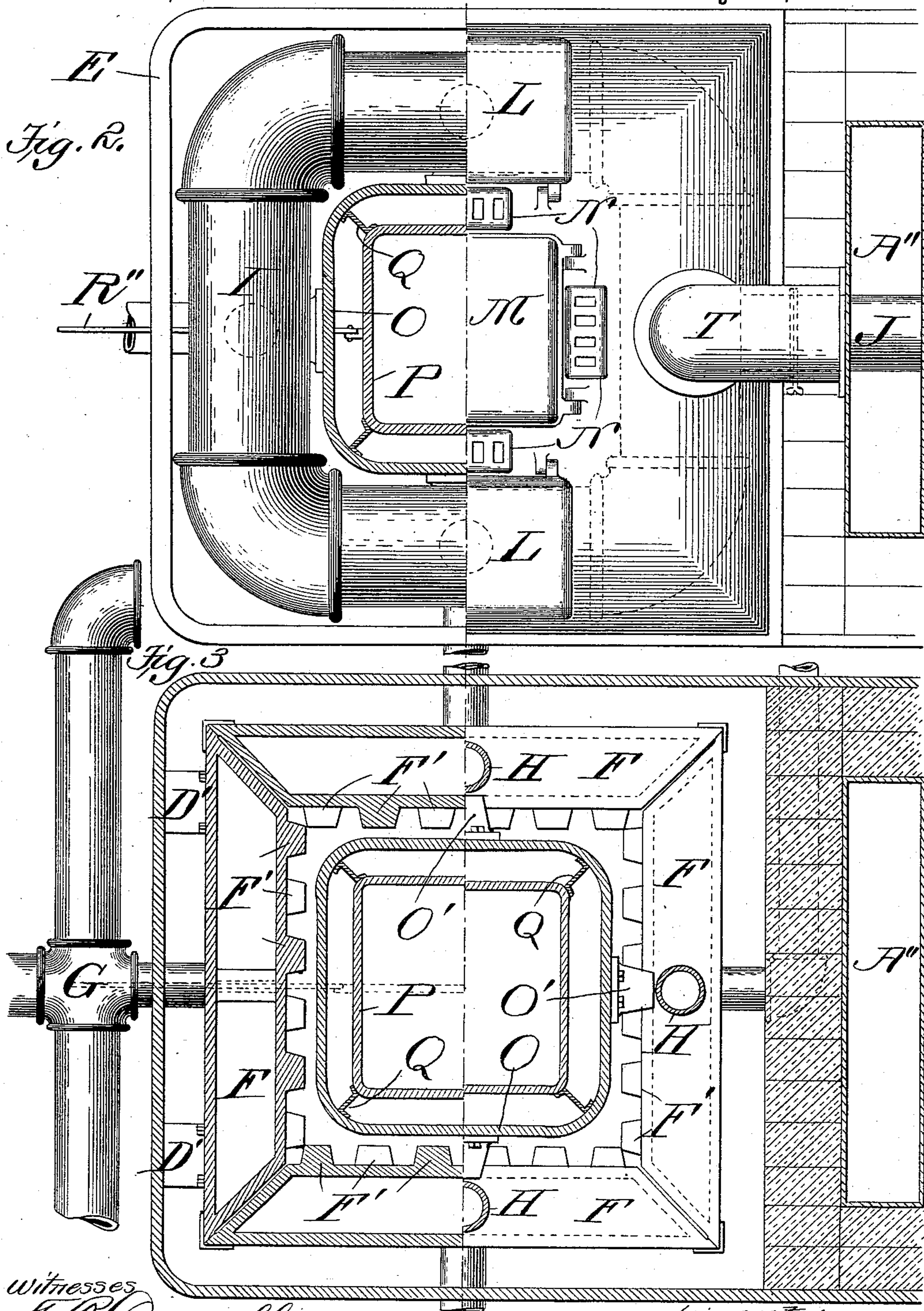
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UNITED STATES PATENT OFFICE.

ROBERT H. LAIRD, OF ST. LOUIS, MISSOURI, ASSIGNOR TO WILLIAM HENRY LAIRD, OF NEW YORK, N. Y.

WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 539,918, dated May 28, 1895.

Application filed August 27, 1894. Serial No. 521,379. (No model.)

To all whom it may concern:

Be it known that I, ROBERT H. LAIRD, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Water-Heaters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, wherein—
Figure 1 is a vertical sectional view. Fig. 2 is a cross-sectional view and plan view on line 2 2, Fig. 1. Fig. 3 is a cross-sectional view on line 3 3, Fig. 1.

This invention relates to a new and useful improvement in water-heaters, and consists, generally stated, first, in combining with an up-draft grate, a feed-magazine which is surrounded by air-flues discharging air at the sides and above the grate-bars, whereby complete combustion of the fuel takes place; second, in arranging vertically-disposed water-sections around the grate, which form a surrounding bridge-wall and an up-draft flue therebetween and the fuel magazine, said water sections being formed at their lower inner edges with air-flues which conduct oxygen from below the grate-bars to a point above the fire to assist in supporting combustion; third, in forming the heat-conducting pins which project inwardly, and which pins are preferably staggered; fourth, in the peculiar arrangement and operation of a trap-door located in the fuel-magazine, which trap-door, also, acts in the capacity of a damper in certain operations of the heater; fifth, in the general arrangement of the flues and the manner of introducing oxygen to support combustion on the grate-bars, and, finally, in the peculiar construction, arrangement, and combination of the several parts comprising my improved water-heater and its location relative to the boiler proper, which will now be fully described and afterward pointed out in the claims.

In the drawings, A indicates an ordinary tubular boiler; A', its main draft-flue; A'', its breaching, terminating in a suitable stack, and A''', its return draft-flues. The boiler and its associate parts are supported by suitable masonry, which, preferably, extends up

in front thereof to form a down draft-flue from the spaces around the water-head to the main draft-flue A'.

B indicates a suitable base for the water-heater, which forms an ash-pit for the grate-bars C, located thereabove, said grate-bars being of any approved or desired type and mounted in the plate D, which plate generally supports the casing and water-sections.

E indicates the casing or shell which incloses the heater.

Mounted on the plate D, are water-sections F, which, in the drawings, are four in number and arranged so as to form substantially a square. These water-sections, however, as well as the other parts constituting my improved heater, can be so shaped as to make the heater circular in cross-section, in which instance each water-section would be in the form of a quarter of a circle. Again, as many water-sections as may be desired may be used and connected together in any suitable manner, so as to preserve the continuity of the high bridge-wall surrounding the entire grate-bars. As the water-sections are now made, save for the front one, but one pattern is necessary, which duplication saves considerable in the cost of production of the heater. The ends of the sections are, preferably, mitered, so that they will expand and contract equally under the existing arrangement of draft-flues, the inner face being of less area, being subjected to the greater amount of heat, will expand to a greater extent, proportionately, than the outer face, which, although of greater area, is subjected to a less degree of heat; therefore, its expansion is less. By mitering the corners, the expansion of the inner and outer faces is equalized, and in order to preserve their relation, I preferably arrange at the corners angle-stirrups which hold the sections together. Projecting inwardly from the faces of the sections, are heat-conducting pins F', which are, preferably, staggered relative to each other, and whose function is, to absorb and transmit heat to the water in the sections, at the same time diffusing the heat throughout the entire surface. At the lower inner edges of the water-sections, are air-conducting ports F'', which open into the ash-pit

and terminate in the combustion chamber above the grate-bars, at a point preferably about the lower end of the fuel magazine.

G indicates a belt feed-pipe, which is supplied with water to be heated, from some suitable source of supply, said belt leading into the bottoms of all of the water-sections F.

Leading from the tops of the water-sections F, are pipes H, which discharge into a continuous water-head I, located at the upper portion of the heater, said water-head being connected by a pipe J to the boiler A or other receptacle for the heated water.

K indicates a cap or cover for the heater, which is preferably formed with openings over the water-head, said openings being closed by doors L, which give access to the interior for the purpose of cleaning the flues, the dirt in the flues between the shell E and the water-section F being disposed of through doors D', in the plate D, and the dirt on the inner faces of the water-sections and on the heat-conducting pins falling through the grate-bars into the ash-pit. Cap or cover K is, also, formed with a central opening, giving access to the fuel magazine from the top, which opening is closed by a door M. Draft openings are, also, located, in the cover K, around the fuel magazine, they being regulated by draft-plates N. The fuel-magazine is composed of double walls O and P, the former, being the outer, having mounted thereon feet O', which extend laterally and rest upon the water-sections F to support the magazine and add rigidity by preventing lateral movement. Bolted, or otherwise secured to the wall O, is an extension O'', which is perforated or formed with openings o in its sides, and whose lower extremity is formed with inwardly projecting flanges upon which is supported the inner wall P of the magazine. Arranged between the walls O and P, and extending the entire length thereof, are partitions Q, preferably in the form of Z-shaped braces, which are located in the four corners, dividing the space between the walls into four flues, at the same time maintaining parity between the walls.

R indicates a downwardly-swinging trap-door, located at the fuel-magazine, whose function is, to close the same to prevent the escape of the gases of combustion when green fuel is introduced at the top of the magazine, and, also, to regulate an up-draft through the magazine in starting the fire, as will herein-after be described. Connected to this trap-door, preferably on its under side, is a link R', to the other end of which link is connected the inner end of an operating rod R'', extending through a way in the front water-section F and shell E. On the under side of this rod R'', is a lug or projection r, which rests on the inner side of the shell E when the trap-door is closed, to hold the same in an elevated position. To cause the trap-door to drop and discharge its supported fuel on to the fire on the grate-bars, it is only necessary to raise the rod R'', which releases the lug r from the

shell E, and allows the rod R'' to move outwardly, which is necessary in this operation of the trap-door. To elevate the trap-door, rod R'' is forced inwardly until its lug r passes shell E and drops behind the same, which will set the trap-door.

Leading from the interior of the magazine to the space above the water-head, is a flue S, which is preferably closed by a suitable damper S', through which the products of combustion pass on first starting a fire. A pipe T also connects the space from above the water-head to the stack. U is a damper in pipe T.

The operation of the heater is as follows: Assuming that the fuel is laid and ready for ignition, trap-door R is dropped, opening a through-draft through the fuel-magazine, flue S, and pipe T, dampers S' and U being opened. In this operation, oxygen is supplied to the fire from the ash-pit, and the draft is entirely upward. After the fire has become sufficiently started, dampers S' and U are closed, and the trap-door R is elevated. Green-fuel is now placed in the magazine on trap-door R, and, when the magazine is full, door M is placed in position. Draft-plates N are now arranged to open the down-draft through walls O and P. Trap-door R is tripped, precipitating the green fuel on the fire, and, if desired, and fuel in the magazine permitting, the trap-door can be again elevated. The course now assumed by the products of combustion, the fire being principally fed by oxygen from the ash-pit, is to pass on the sides of the magazine, and intermingling with the oxygen from ports F'' and opening o, complete combustion will take place. It will be noted that the products of combustion are compelled to pass between two oppositely-inflowing streams of oxygen, so that complete intermixture is the result, followed by a thorough combustion. The gases then arise around the fuel magazine, and on the inner faces of the water-sections, distributing their heat over said water-sections (considerable number of heat units being absorbed by the heat-conducting pin), and, upon reaching the top of the water-sections, will pass around (above and below) the water-head I, thence downwardly outside of the water-sections to the main-flue A' under the boiler. The products of combustion return through the tubes A''' into the breaching A'' and out through the stack.

It will be seen from the above operation that a maximum number of heat units are absorbed by the water-sections and water-head, and that a complete combustion of the fuel is accomplished, giving a maximum heat from a given quantity of fuel.

The circulation of the water is as follows: Being admitted at the lower ends of the sections, the heat will naturally cause it to rise and induce a circulation upward through the pipes H into the water-head I, and, by pipe J, into the boiler A, which it feeds with water at a very high temperature—thus causing the

efficiency of the boiler to be constant, which would not be the result if cold water were introduced at various times in feeding the boiler, which would chill the same and cause an irregular pressure. It will, also, be noted that the improved water-heater as herein shown and described forms substantially a part of the boiler, covering the entire front thereof, and that the heat generated for the heater is utilized for the boiler.

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

1. In a water-heater, the combination with the water-sections, of a fuel-magazine consisting of two walls, brace-bars extending the length of said walls and dividing the space therebetween into flues, draft-plates for regulating the inflowing air at the top of the flues, and perforations formed in the outer wall near its lower edge, substantially as described.

2. In a water heater, the combination with a suitable shell or casing, of water-sections arranged therein, grate bars, and a fuel-magazine located above the grate-bars, said fuel-magazine consisting of an outer and an inner wall, said outer wall having an inwardly projecting flange at its lower edge upon which the inner wall is supported, substantially as described.

3. In a water heater, the combination with a suitable shell or casing, of grate bars, water-sections arranged around said grate bars, a fuel-magazine arranged above the grate and between the water-sections, said fuel magazine being formed of two walls, between which an air flue is formed, which discharges above the grate-bars, pipes which lead to all of said water-sections, a water-head arranged above the sections, and a connection between the water-head and each of said sections, substantially as described.

4. In a water-heater, the combination with water-sections formed with heat-conducting pins on their inner faces, of a belt-pipe which leads to all of said sections, a water-head arranged above said water-sections, and a connection between the water-head, and each of said sections, substantially as described.

5. In a water-heater, the combination with a suitable shell, of grate-bars, water-sections arranged around said grate, a fuel-magazine located above the grate, and forming an up-draft flue in connection with the water-sections, said fuel-magazine being composed of two walls, between which is formed a down-draft flue opening into the up-draft flue near the bottom of the magazine, and ports F'' which open into the ash-pit and discharge into the up-draft flue, substantially as described.

6. In a water-heater, the combination with the grate-bars, of water-sections arranged around said grate-bars, a fuel-magazine formed with flues inducing oxygen to support combustion above the grate-bars, said water-sections containing air-ducts and ports there-

in, said ports opening into the combustion-chamber opposite the point of discharge of the magazine flues, substantially as described.

7. In a water-heater, the combination with a suitable shell or casing and grate-bars, of water-sections arranged around said grate-bars and forming a combustion chamber thereabove, a fuel-magazine which is located in the combustion chamber, said magazine being formed with air flues leading from the exterior, which discharge into the combustion chamber, and flues which open into the ash-pit and discharge into the combustion chamber substantially in an opposite direction from the discharge of the air from the magazine-flues, substantially as described.

8. In a water-heater, the combination with a suitable shell or casing, of grate-bars, water-sections arranged above the grate-bars, a fuel-magazine located above the grate-bars, a downwardly swinging door located in said fuel-magazine, a link attached to the under side of said trap-door, an operating handle which is connected to said link, and which extends out through the shell, and means on said handle for retaining the door in an elevated position, substantially as described.

9. In a water-heater, the combination with an inclosing shell or casing, of grate-bars and water-sections located therein, a fuel-magazine located above the grate-bars, between which and the water-sections is formed an up-draft flue, and between the water-sections and shell is formed a down-draft flue, a trap-door damper located in the fuel-magazine, a flue S which leads from the top of the magazine, and a pipe T which leads from the top of the casing or shell to a stack, substantially as described.

10. In a water-heater, the combination with an inclosing shell, of grate-bars, water-sections arranged above the grate bars, pipes leading to the several sections, a water-head which is connected to the several sections by pipes, and a tubular boiler to which the water-head is connected, beneath which tubular boiler the products of combustion pass from the grate-bars, substantially as described.

11. In a water-heater, the combination with an inclosing shell, of grate-bars located therein, water-sections located above the grate-bars, between which sections and the shell is formed a down-draft flue which opens into a flue beneath a tubular boiler, a fuel-magazine which is located above the grate-bars, between which magazine and the inner walls of the water sections, is formed an up-draft flue which connects with the down-draft flue above the water sections, and a tubular boiler, through which the products of combustion pass, substantially as described.

12. In a water-heater, the combination with an inclosing shell, of grate-bars, water-sections located above said grate bars, between which and the shell is formed a down-draft flue, which opens into a draft flue beneath a tubular boiler, a fuel-magazine located above the

grate-bars, between which and the water-sections is formed an up-draft flue, which connects with the down-draft flue at the top of the water-sections, a tubular boiler, a stack
5 for said boiler, and a pipe T provided with a damper, which leads into said stack from above the water-sections, substantially as described.

In testimony whereof I hereunto affix my signature, in presence of two witnesses, this 10 22d day of August, 1894.

ROBERT H. LAIRD.

Witnesses:

F. R. CORNWALL,
HUGH K. WAGNER.