

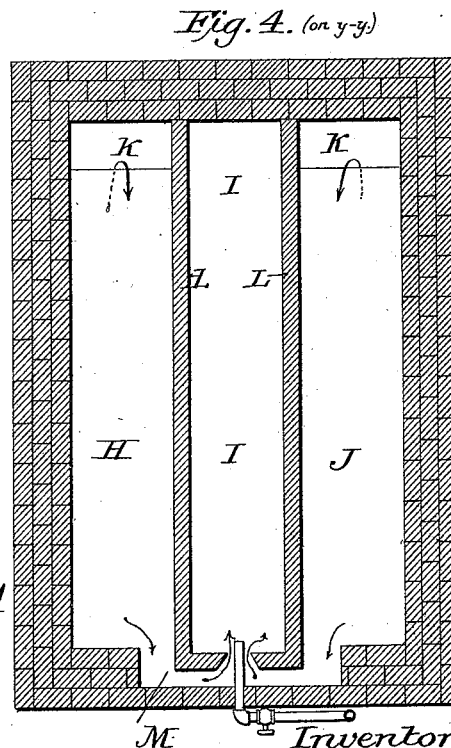
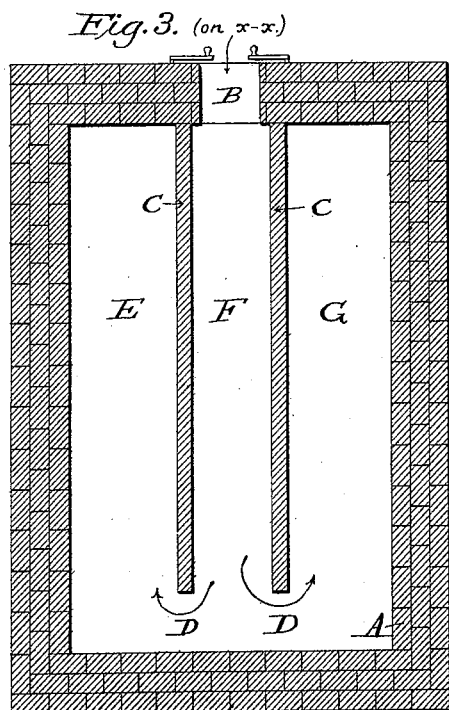
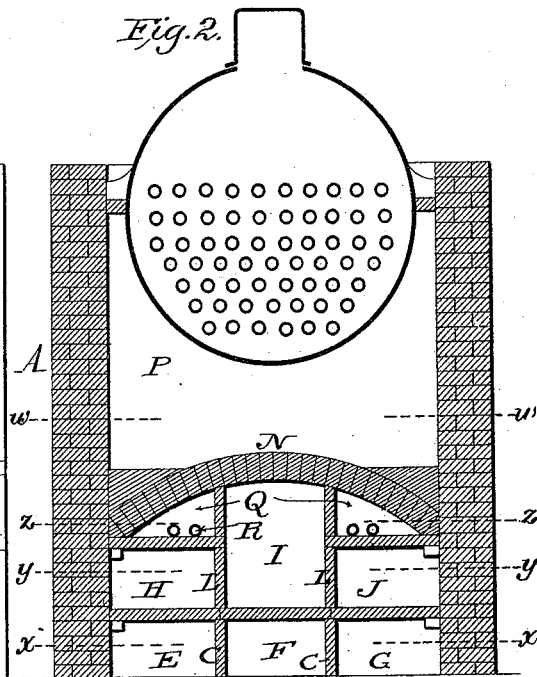
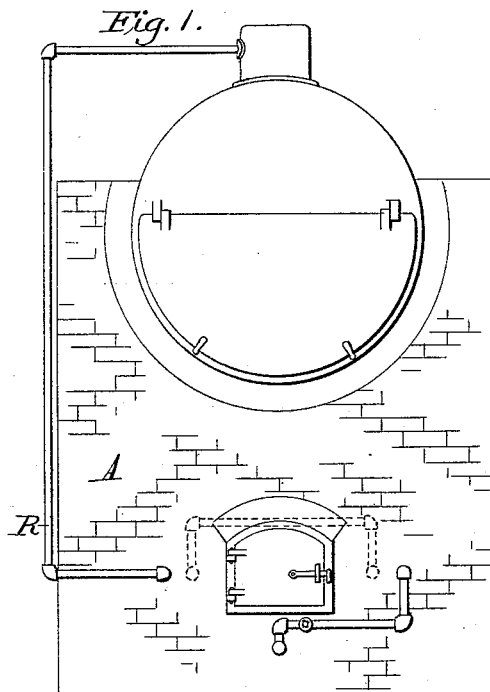
(No Model.)

2 Sheets—Sheet 1.

W. LAWRIE & J. McMILLAN.
FURNACE.

No. 421,589.

Patented Feb. 18, 1890.



Witnesses:

James F. Duhamel
Horace A. Dodge

Inventors:

William Lawrie
John McMillan,
by Dodge & Sons atty.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 5. (on z-z.)

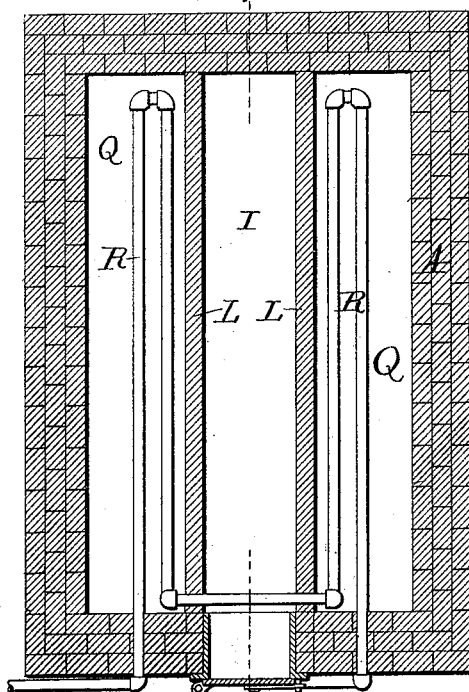


Fig. 6. (on w-w.)

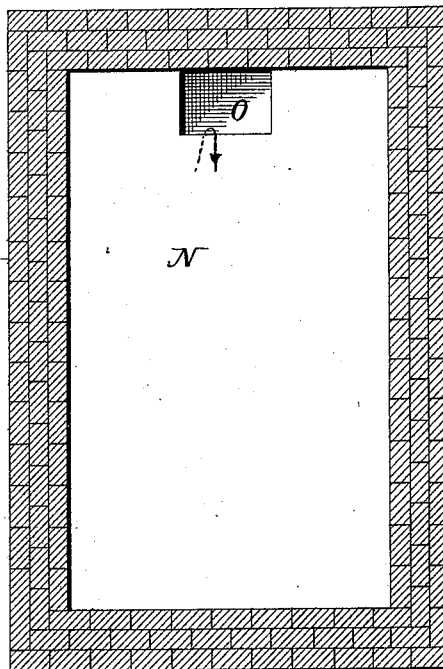
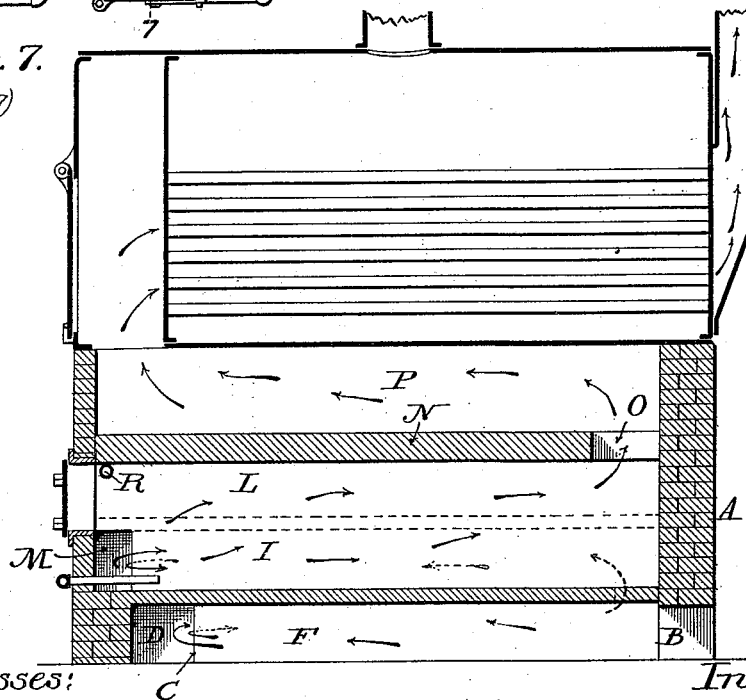


Fig. 7.
(on 7-7)



Witnesses:

James D. Duhamel
Horace A. Dodge.

Inventors:

William Lawrie,
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by *Dodges Sons, Atty.*

UNITED STATES PATENT OFFICE.

WILLIAM LAWRIE AND JOHN McMILLAN, OF PETROLIA, ONTARIO, CANADA,
ASSIGNORS, BY MESNE ASSIGNMENTS, TO JOHN McMILLAN, TRUSTEE, OF
SAME PLACE.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 421,589, dated February 18, 1890.

Application filed January 24, 1889. Renewed January 13, 1890. Serial No. 336,718. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM LAWRIE and JOHN McMILLAN, citizens of the Dominion of Canada, residing at Petrolia, in the county of Lambton and Province of Ontario, Canada, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

Our invention relates to that class of furnaces designed more particularly for burning gas or liquid fuel; and it consists in a novel construction and arrangement of the flues thereof, whereby the combustion is rendered thorough.

In the accompanying drawings, Figure 1 is a front face view of our improved furnace; Fig. 2, a transverse vertical sectional view of the same; Figs. 3, 4, 5, and 6, horizontal views on the lines *x x*, *y y*, *z z*, and *w w*, respectively; and Fig. 7, a vertical longitudinal sectional view through the center of the furnace on the line 7 7.

While in the drawings we have shown the invention as applied to the heating of a steam-boiler, it is apparent that it is also applicable to oil-stills, whether horizontal or vertical, or for any other purposes where high temperature is required.

In carrying out our invention we heat the air before admitting it to the combustion-chamber, and also superheat the steam by which the hydrocarbon gas or other liquid fuel is injected, thereby insuring a thorough commingling of the particles of air, steam, and oil or gas, and a consequent economization of fuel and the production of an intense heat.

A indicates the furnace as a whole, provided at its rear with an opening or inlet B. Extending along the floor parallel with the side walls of the furnace are partitions C C, which extend nearly to the front wall of the furnace and terminate a short distance therefrom to form passages D, the said partitions C dividing the floor-space of the furnace into three chambers E, F, and G, as shown in Figs. 2, 3, and 7. The partitions C will be made of fire-brick or other heat-resisting substance, and the tops of the flues or passages E F G thus formed will be made of fire-clay or other

suitable material. Directly above the passages or chambers E F G are similar passages H, I, and J, the first and last of which communicate with the flues E and G at the rear end of the latter through openings K, formed by the roofs or covers of the flues E G, stopping short of the rear end of the furnaces, as shown in Figs. 4 and 7. Directly over the partitions C are similar partitions L, which extend from the rear of the furnace-wall nearly to the front and separate the chambers H, I, and J, except at the front end, where by forming recesses M in the front wall of the furnace communication is established between the flues or passages H J and the central flue or passage I. It is not essential that the front wall of the furnace be recessed, as shown in Fig. 4, as it is apparent that the partitions L may terminate a distance therefrom in a manner similar to the partitions C. (Shown in Fig. 3.)

The top of the combustion-chamber I is covered by means of an arch N (shown in Figs. 2, 6, and 7) and communicates at the rear end of the furnace with the space beneath the boiler by means of an opening O, formed through the arch, as shown in Figs. 6 and 7. From this arrangement it will be seen that the air entering at the rear end of the furnace through the central flue F, passes forward to the front end thereof, thence through openings or passages D into the flues E and G back to the rear end of the furnace, up through openings K into the flues or passages H J, thence forward again to the front end of the furnace, thence, by means of passages M in the front wall of the furnace, into the front end of the central mixing-chamber I toward the rear end of the furnace, and finally up through the opening O into the heating-chamber P.

The top of the flues H and J are provided with covers which extend from end to end of the furnace, thereby forming chambers or pockets Q, which are closed on all sides, as shown in Figs. 2 and 5.

R indicates a steam-pipe extending from the dome of the boiler into one of the pockets or chambers Q, as shown in Figs. 2 and 5, the said pipe traversing the length of the

chamber one or more times and extending to the opposite side of the furnace, where it traverses in a similar manner the other pocket Q. After leaving the pocket Q the pipe 5 passes out at the front wall of the furnace and re-enters the same at the front end of the mixing or combustion chamber I, as shown in Figs. 1, 4, and 7, where it is provided with an injector-burner of any suitable construction, 10 by means of which the liquid fuel or gas is injected into the mixing-chamber. It will be noticed from this construction that the steam will be highly superheated, and that as it issues from the pipe Q into the mixing-chamber I it will suck or draw in through the 15 opening in the front end of said chamber a large quantity of air which has become heated by its circuitous travel through the flues E, F, G, H, I, and J. By making the mixing-chamber I comparatively small the flame 20 from the injector-burner is caused to impinge on the fire-brick or fire-clay linings or covers of the air-flues, thereby splitting up the hydrocarbon into minute particles and mixing it thoroughly with the heated air, &c., 25 and producing practically complete combustion and a saving of fuel over prior plans.

We are aware that it is not broadly new to cause the air to travel circuitously, and 30 thereby become heated before being delivered into the combustion-chamber.

Having thus described our invention, what we claim is—

1. In a furnace, the combination, with the 35 central air-inlet flue F and the return-flues E G, communicating therewith, of the flues H J, located above and communicating with the rear ends of the flues E G, a mixing-chamber I, located directly over the flue F 40 and communicating at its forward end with the flues H J, a chamber P above the chamber I, and an arch N, covering chamber I and provided with an opening O, all substantially as shown.

2. The furnace A, provided with central 45 inlet-passage F, return-passages E G, communicating with passage F at the front of the furnace by openings D D, flues or passages H I J directly above the flues E F G, 50 openings K K, connecting the rear ends of the flues E G and H J, and openings M M, connecting the passages H and J with the passage I at the front end of the latter, and an outlet O at the rear end of the passage I.

3. The furnace A, provided with the air- 55 inlet flue F, return-flues E, G, H, and J, con-

necting at alternate ends and causing a circuitous travel of the air, the mixing-chamber I, receiving the heated air from the flues H J, and an injector-burner projecting into 60 the end of the mixing-chamber, whereby the air, steam, and oil or gas are thoroughly mixed and perfect combustion secured.

4. In a furnace, the combination, with the main body having an air-inlet B, of the short 65 partitions C C, dividing the floor-space into flues E, F, and G, the latter E G connecting with the former F by passages D D, covers for said flues E F G, partitions L, dividing the space above the flues E F G into similar 70 flues H I J, two of which H and J communicate with the flue I and the flues E G, an outlet in flue or chamber I, and an injector-burner extending into the chamber I, all substantially as shown. 75

5. In a furnace for burning hydrocarbons or other liquid fuels, the combination, with the mixing-chamber I, of the closed pockets Q Q, and the steam-pipe passing through said 80 pockets and serving to deliver superheated steam to the injector-burner.

6. In a furnace, the combination, with the communicating passages E F G and H I J, arranged in two series, one above the other, 85 and having their walls made of fire-clay or other heat-resisting substance, of the pockets Q Q and the injector-burner extending into the chamber or passage I.

7. In a furnace of the class described, the combination, with the recessed front wall, of 90 the mixing-chamber I, provided with an opening in its front end and a discharge-opening at its rear, the air-flues on each side of the mixing-chamber communicating therewith, and an injector-burner extending into the 95 open end of the mixing-chamber.

8. In a furnace for burning liquid fuel or gas, the combination, with the mixing-chamber provided with an injector-burner and 100 with openings around said burner, of a series of flues or passages within the furnace communicating with the mixing-chamber through the openings therein, whereby heated air is delivered into the mixing-chamber.

In witness whereof we hereunto set our 105 hands in the presence of two witnesses.

WILLIAM LAWRIE.
JOHN McMILLAN.

Witnesses:

H. J. DAWSON,
WM. J. CLARKE.