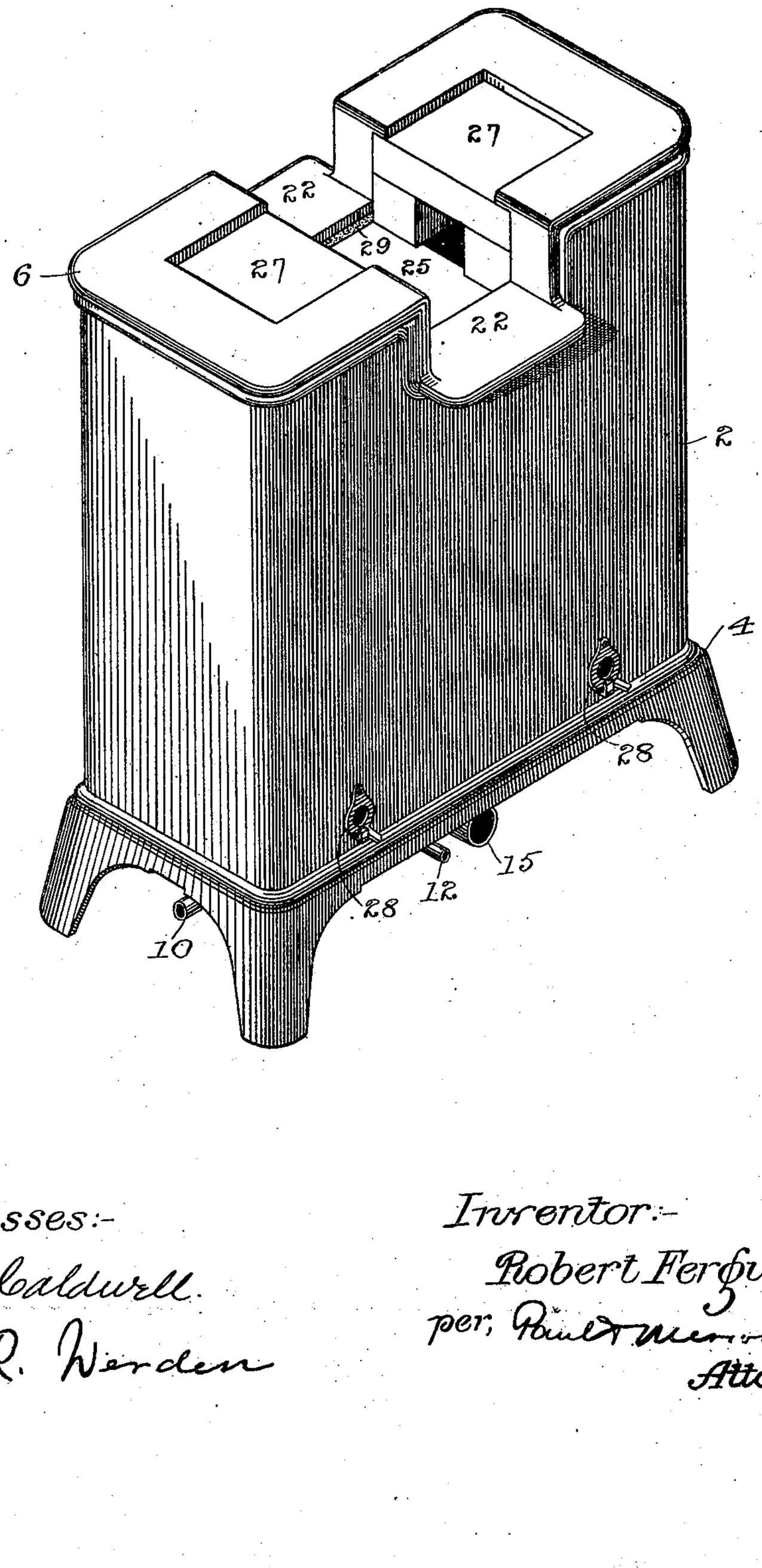
(No Model.) 2 Sheets—Sheet 1.

R. FERGUSON.

HYDROCARBON FURNACE.

No. 502,710. Patented Aug. 8, 1893.

Fig. 1.



Witnesses:-
C. L. Caldwell.
B. R. Werden

Inventor:-
Robert Ferguson,
per; Paul Thomson
Attorneys.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

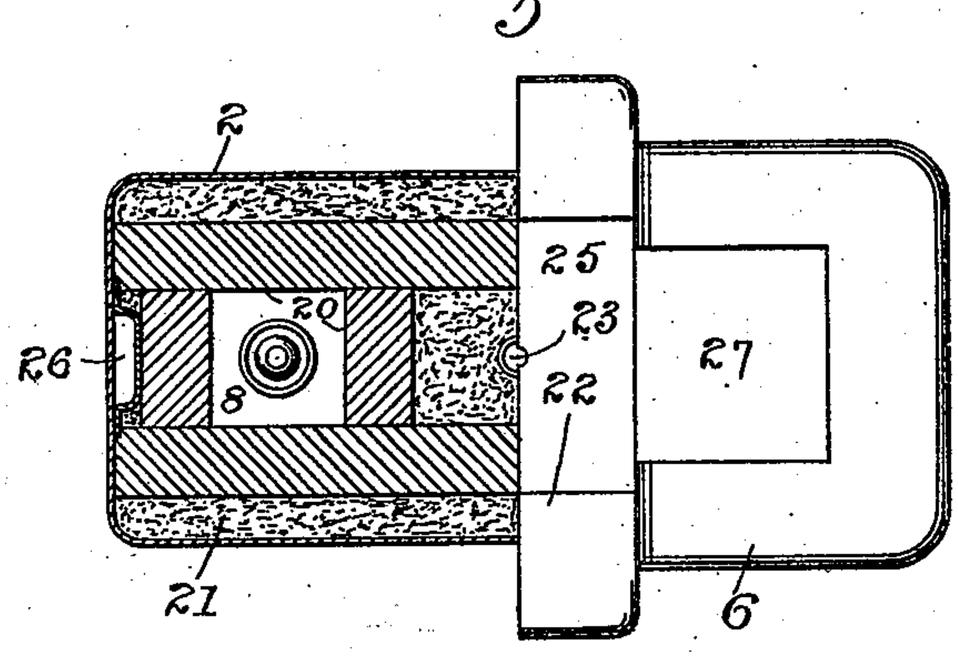


Fig. 6.

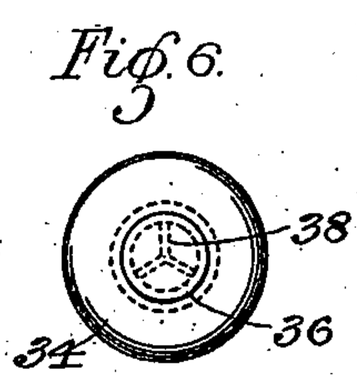


Fig. 5.

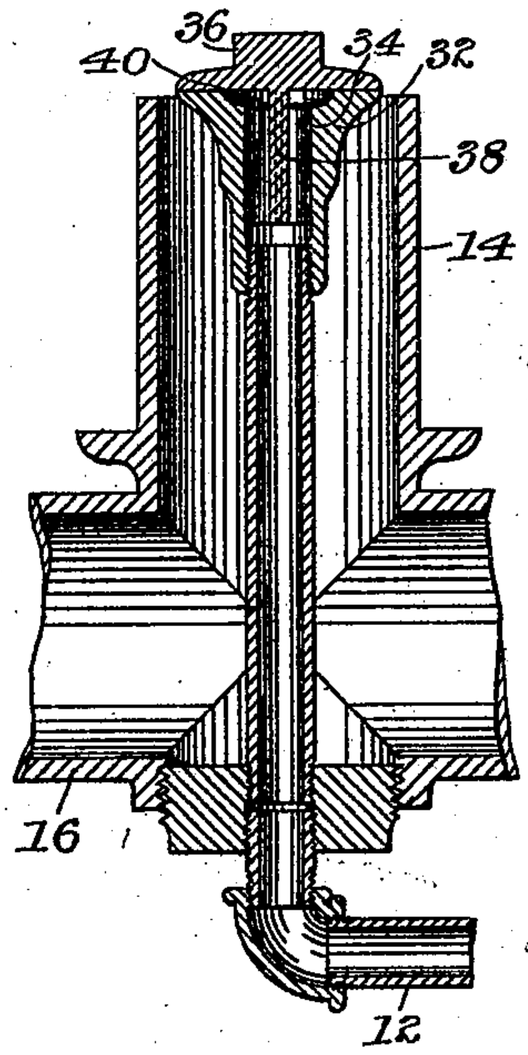


Fig. 2.

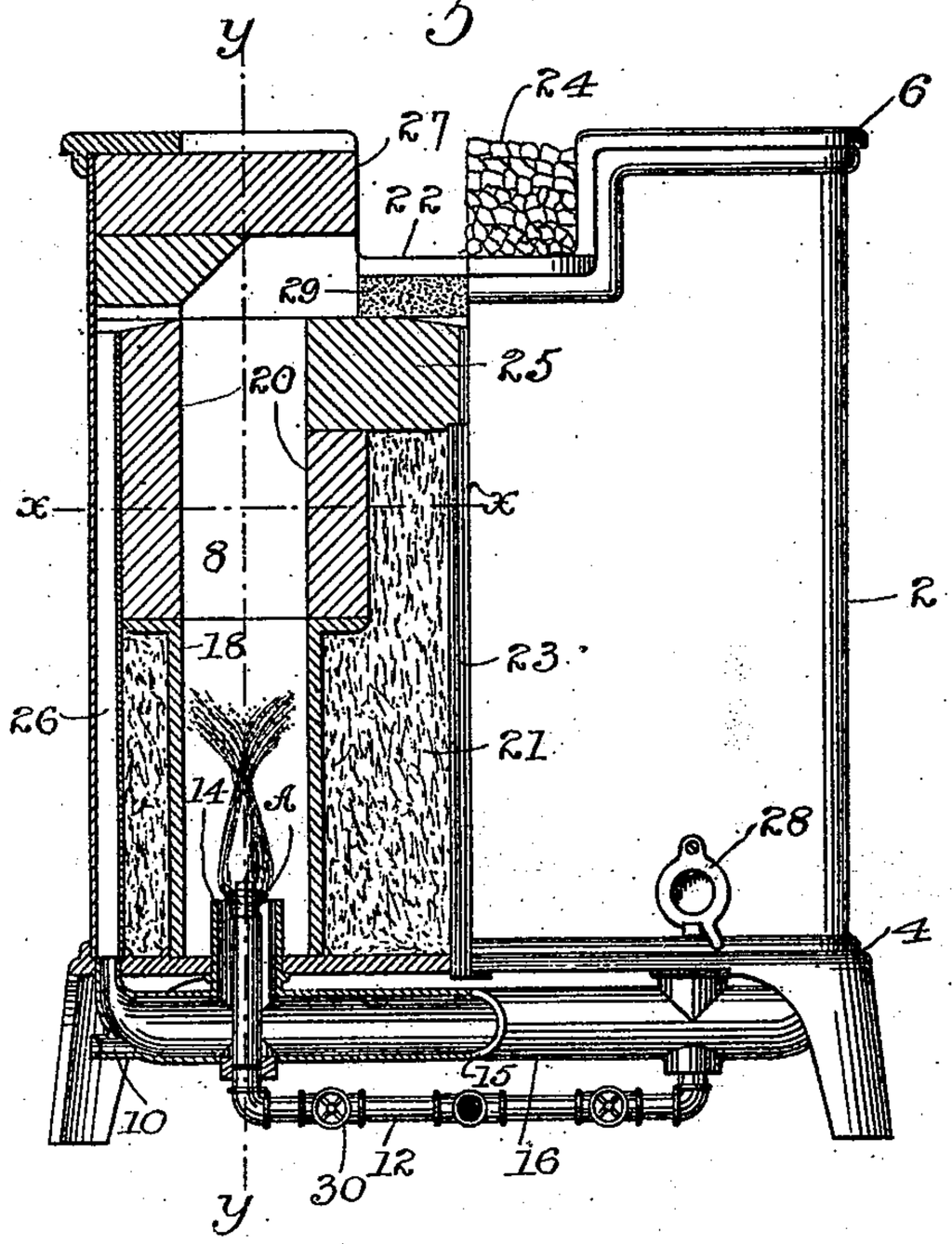
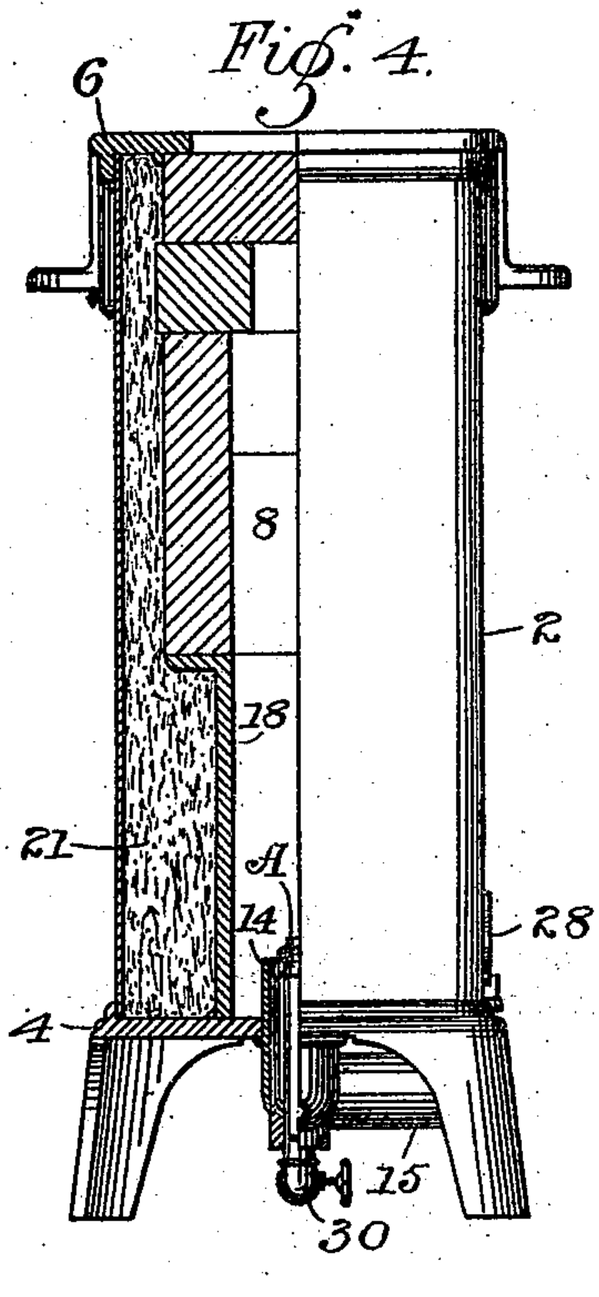


Fig. 4.



Witnesses:-
le. L. Baldwell.
B. R. Werden

Inventor:-
Robert Ferguson,
per; Paul Newman
Attorneys.

UNITED STATES PATENT OFFICE.

ROBERT FERGUSON, OF ST. PAUL, MINNESOTA.

HYDROCARBON-FURNACE.

SPECIFICATION forming part of Letters Patent No. 502,710, dated August 8, 1893.

Application filed March 31, 1891. Serial No. 387,194. (No model.)

To all whom it may concern:

Be it known that I, ROBERT FERGUSON, of St. Paul, Ramsey county, Minnesota, have invented certain Improvements in Hydrocarbon-Furnaces, of which the following is a specification.

My invention relates to improvements in forges heated by the burning of vaporized liquid hydro carbons, its object being to provide a simple and efficient type of forge, and consists in an improved form of burner, a regenerator or combustion chamber and a connected air blast, and auxiliary or lateral air blasts connecting therewith for the most efficient combustion of the hydro carbon gases.

My invention further consists in the construction and combination hereinafter described and particularly pointed out in the claims.

In the accompanying drawings forming part of this specification Figure 1 is an isometrical projection of my improved forge, showing the connecting air and oil pipes. Fig. 2 is a partial central, vertical, longitudinal section of the same, showing the arrangement of the burner in the combustion chamber, the air blast pipes connecting with the burner, and the upper portion of the combustion chamber, and the interior construction of the forge. Fig. 3 is a partial, horizontal section of the same on line *x*—*x* of Fig. 2. Fig. 4 is a partial, vertical, cross section of the same on line *y*—*y* of Fig. 2. Fig. 5 is a sectional detail of the burner, and Fig. 6 is a detail plan view of the top of the burner.

In the drawings, 2 represents the exterior shell or wall of the forge made preferably of sheet metal, having a suitable base 4 and cast iron top 6. Arranged within the same, are one or more vertical combustion or regenerating chambers 8, at the bottom of each of which is arranged the burner A, connected to the feed oil pipe 12. Surrounding the burner is the air blast pipe 14 connected to the feed air pipe 16 and the main 15. The wall 18 surrounding the lower part of the chamber 8, is preferably of cast iron, and the upper portion 20 of fire brick. Surrounding the wall 18 is a mass of any suitable non combustible material such as mineral wool, asbestus or clay.

As shown in the drawings, the forge is provided with two burners and two combustion chambers or flues, one at each end which converge inward at the top toward the center of the forge and open over the hearth 25 of fire brick which forms a recess or depression in the center of the forge between the higher parts 22 of the hearth which are integral with the frame or top of the forge top. Upon the hearth is placed a mass of refractory material such as broken fire brick 24 to absorb and radiate the heat from the burning gases, the fire brick 27 forming the top of the flue from the combustion chamber, the top of the forge resting upon it.

Opening downward through the forge from the hearth 25, is the cinder flue 23, through which cinders and ashes drop to the ground. The space between the brick and iron parts of the hearth, 25 and 22, is filled in with clay 29.

At each end of the forge is arranged a vertical flue 26 connecting with the feed air pipe 16, and opening laterally into the top of the combustion chamber as it turns toward the center of the forge.

In the side wall of the forge adjacent to the burner is arranged a valve opening 28 by which access is given to the burner for purpose of lighting or cleaning, the pipe 16 having also end openings 10 through which access is afforded to the interior for cleaning purposes. The main air pipe is provided with suitable means for forcing air therethrough to create a draft. The oil pipe 12 is connected with a suitable elevated source of supply, and is provided with valves 30 to determine the flow of oil through the burner.

The burner consists of a body 32 having a cylindrical opening 34 therethrough, screw-threaded upon the vertical oil pipe. The upper end of the body is enlarged or flares outwardly toward the inclosing walls of the air pipe 14, forming substantially an inverted cone whereby the passage or vent is restricted, causing the air to be carried through with great force. The upper end of the opening through the body 32 is enlarged into the cup shape cavity 40. Resting of its own weight upon the flat top of the body 32 as a seat is the valve 36, which is held from lateral dis-

placement by the flanged projection or stem 38 extending downwardly into the opening 34. The valve is lifted from its seat by the pressure of the oil in the pipe from the head in the reservoir or tank, the valve rising a sufficient distance to allow a thim film of oil to escape around its edge, when it is caught up by the air blast and driven upward through the combustion chamber.

The operation is as follows: The valve 30 being turned to admit oil to the burner, the pressure lifts the valve and the oil oozes out around the edge. The valve 28 is then opened to permit the lighting of the oil with cotton waste or other suitable material, after which the valve 28 is closed, and air is forced through the pipe 14 by any suitable means, such as a blower connected to the main 15, around the burner which carries the oil upward as it issues from the burner, by its force comminuting or breaking it into fine particles. These rise first in a conical form, and then spread outward into the form of an inverted cone, as shown in Fig. 2, above which is the point of combustion. The iron walls around the lower part of the chamber therefore do not become excessively heated, but the brick around the upper part gradually becomes heated to a high degree, and radiating the heat causes the oil as it rises in the chamber to be thoroughly vaporized and to burn freely, the upper part of the combustion chamber thus constituting a regenerating chamber. The oil vapors are however not thoroughly consumed until brought in contact with the air forced through the vertical flues 26 at the top of the chamber, as it approaches the outlet at the hearth. The pressure and volume of air flowing through the air pipes may be adjusted in such manner that the combustion of the oil vapors is complete before they reach the broken brick upon the hearth. This broken brick absorbs the heat from the flames until raised to a high temperature. The object to be heated or worked then being placed in the midst of the mass is heated as desired. As the air pipe 16 becomes clogged by dirt or cinders falling through the flue 26 and the pipe 14, it is cleaned by removing the plug from the opening 10 through which the material is removed. The cinders and ashes from the hearth are discharged downward through the cinder flue 23.

I claim—

1. In a device of the class described, the combination of the combustion chamber, a vertical air pipe arranged therein, an oil pipe arranged within said air pipe, a gravity valve seated over the end of said oil pipe, means for directing a flow of oil through said pipe to lift said valve, and means for forcing air through said air pipe to comminute and carry said oil upward, substantially as and for the purposes set forth.

2. The combination with a suitable combustion chamber, of a burner arranged therein comprising in combination a body of substantially the form of an inverted cone, having a vertical opening therethrough connecting with a supply pipe, a flat lift valve seated upon the end of said body closing said opening, an air pipe surrounding said burner, and means for forcing air therethrough, substantially as described.

3. In a hydro carbon burner, the combination of a body of substantially the form of an inverted cone, having a vertical opening therethrough, a flat lift valve seated upon the upper end of said body closing said opening, an open end pipe surrounding said burner the intermediate passage being constricted adjacent said opening, and means for forcing an air blast therethrough, substantially as described.

4. In a hydro-carbon burner, the combination of the open end vertical oil pipe, the lift valve seated thereon, and the air pipe surrounding said oil pipe, and having the passage adjacent the end of the oil pipe constricted, substantially as described.

5. The combination with the hydro-carbon burner, having a horizontal circumferential opening for the emission of oil, of a valve for closing said opening adapted to be operated by the pressure of the oil in the pipe, and a vertical air pipe surrounding the burner having the intermediate passage constricted opposite the opening, substantially as described.

6. The combination of a hydro carbon burner having a horizontal circumferential opening, automatic means for adjusting the flow of oil therethrough, and a vertical air blast pipe surrounding said burner having its passage constricted approximately opposite said opening, substantially as described.

7. In a device of the class described, the combination of the vertical combustion chamber 8, having the brick walls 20, the burner A at the bottom of said chamber, the vertical air blast pipe 14 surrounding said burner, the air blast 26 communicating with said chamber at or near its top, and the hearth 22 at the side of which said combustion chamber opens, substantially as described.

8. In a furnace, the combination of one or more vertical combustion chambers having fire brick walls and leading to a suitable hearth upon the top of the furnace, vertical burner pipes at the bottom of said chambers, a feed air pipe underneath said furnace, a vertical blast pipe connecting with said feed air pipe and surrounding each of said burner pipes, air flues connecting with said feed air pipe and entering said combustion chamber near the top and directed toward said hearth,

and means for controlling the flow of air and oil through said blast and burner pipes, substantially as described.

9. A hydro-carbon burner comprising in combination, the oil pipe, the circumferential oil outlet, the valve for closing said outlet adapted to be opened by the pressure of the oil in the pipe, the air pipe surrounding and coaxial with said oil pipe having the passage between it and the oil pipe constricted opposite the oil outlet, substantially as described.

In testimony whereof I have hereunto set my hand this 27th day of March, 1891.

ROBERT FERGUSON.

In presence of—
T. D. MERWIN,
A. MAE WELCH.