(No Model.) 2 Sheets—Sheet 1.

D. CHURCH.

Burning Hydrocarbon.

No. 238,852. Patented March 15, 1881.

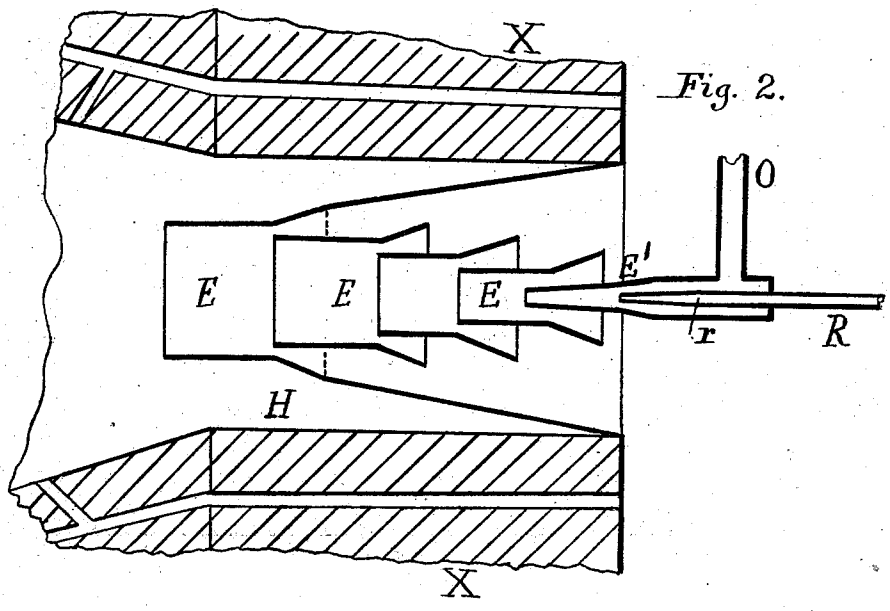


Fig. 2.

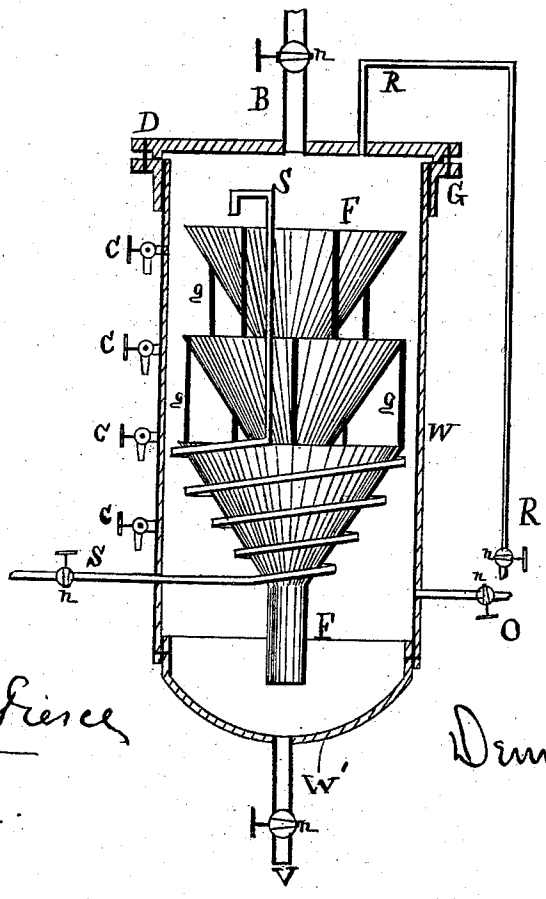


Fig. 1.

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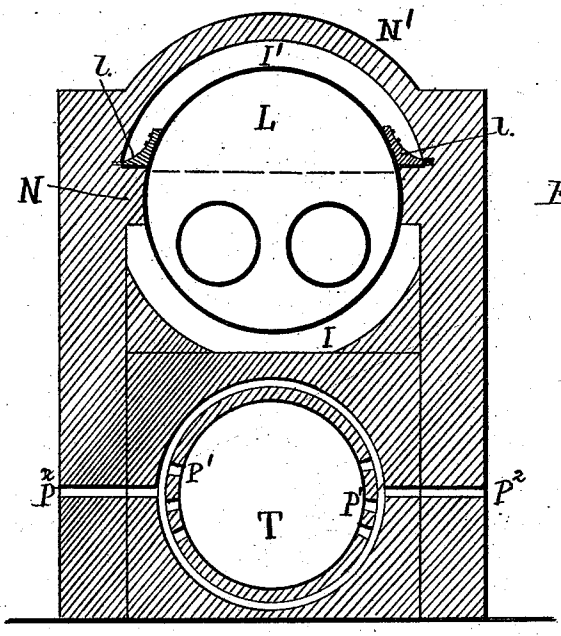


Fig. 4.

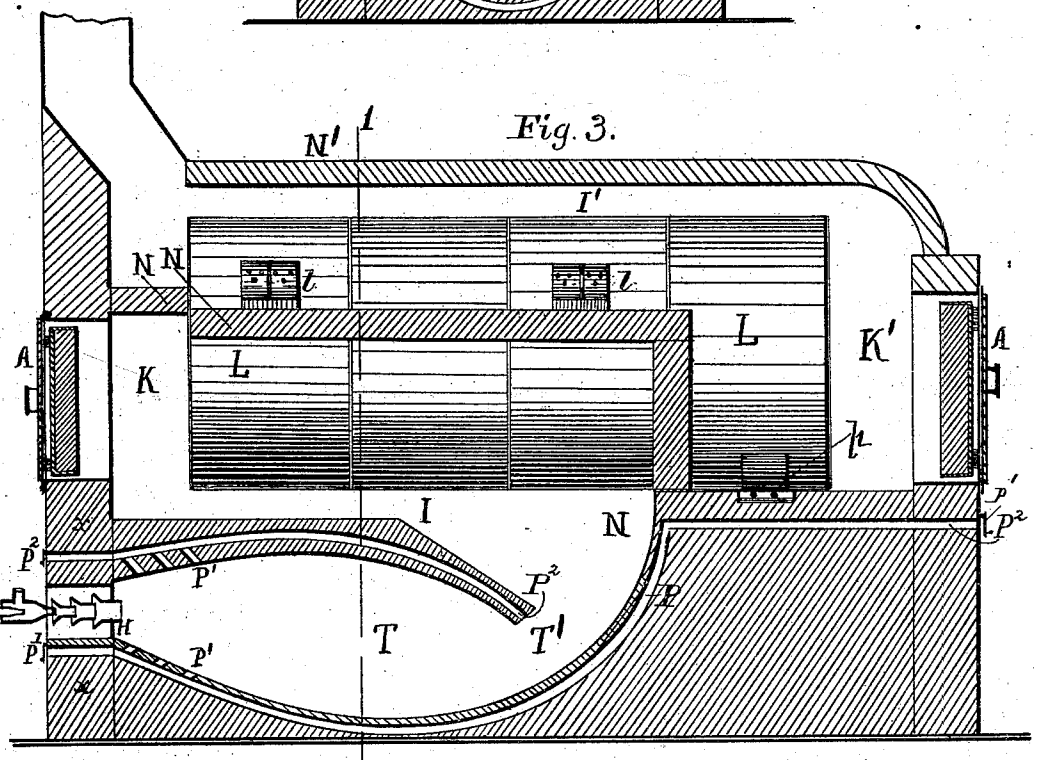


Fig. 3.

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UNITED STATES PATENT OFFICE.

DENNIS CHURCH, OF GRAND RAPIDS, MICHIGAN.

BURNING HYDROCARBON.

SPECIFICATION forming part of Letters Patent No. 238,852, dated March 15, 1881.

Application filed August 30, 1880. (No model.)

To all whom it may concern:

Be it known that I, DENNIS CHURCH, a citizen of the United States, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Methods of and Means for Burning Hydrocarbons; and I do hereby 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 letters or figures of reference marked thereon, which form a part of this specification.

In the drawings, Figure 1 is a vertical section of an oil-tank; Fig. 2, an enlarged sectional view of the door of a furnace and the injector for delivering the hydrocarbon. Fig. 3 is a vertical longitudinal section of a furnace, and Fig. 4 is a vertical transverse section of the furnace.

Like letters refer to like parts wherever they occur.

My invention relates to the method of and means for burning hydrocarbons; and it consists, first, in heating the liquid hydrocarbon, previous to its introduction into the combustion-chamber, by means of steam, and employing any gases thus generated, together with the steam-pressure, for both forcing and injecting the heated hydrocarbon into the combustion-chamber of the furnace; secondly, in a heating and vaporizing tank for hydrocarbons, provided with a series of separators for facilitating the separation of water, dirt, and other impurities from the liquid hydrocarbon employed as fuel; thirdly, in the combination of an injector with a combustion-chamber having hollow perforated walls, which surround the burner and deliver air to the exterior of the jet; and, finally, in details of construction and combinations of devices hereinafter more fully set forth.

I will now proceed to describe my invention more specifically, so that others skilled in the art to which it appertains may apply the same.

In Fig. 1 is shown the heating-tank for heating the hydrocarbon previous to its introduction into the furnace. It is preferably of cylindrical form, having a shell, W, closed below by a concave head or hopper-bottom, W′, and above by a removable cap or cover, D. The shell W and bottom W′ are preferably made of boiler-iron, and the head or cover D of cast-iron, the shell W being provided with a cast-iron ring, G, the flange of which forms a seat for the cover D; but the cylindrical form is not essential, and the tank may be made entirely of boiler-iron, or may be cast, as preferred.

B indicates a large pipe, through which the tank may be charged with hydrocarbons; and V, a discharge-pipe, through which the tank may be emptied. The pipe V is centrally located, and is used to draw off the water, dirt, and sediment when the hydrocarbon employed is lighter than water; but when tar or like substance heavier than water is used, then a series of draw-off cocks, *c c*, are arranged in the shell W, as shown in the drawings. These draw-off cocks *c c* may also be used for testing the height of liquid in the tank.

Arranged within the tank one above the other, and properly supported, are a series of funnels, F F, the function of which is to collect all dirt and solid substances and discharge them at the bottom of the tank. In case a hydrocarbon lighter than water is used these funnels will also serve to collect water and prevent it from mixing with the heated hydrocarbon.

In order to heat the contents of the tank a steam-pipe, S, is used, said pipe being coiled in the bottom of the tank, and extending thence upward to near the top of the tank, where it is preferably bent, as shown at *s*, to discharge the steam downward.

R is a pipe through which live steam and gas are conducted from the tank to the injector, and O is a pipe for conveying the heated hydrocarbon from the tank to the injector.

The several pipes leading to and from the heating-tank are supplied with suitable valves, *n*.

The injector which I preferably employ (see Fig. 2) is composed of the jet *r*, connected to or forming the termination of pipe R, which delivers live steam and gas from the top of the heating-tank, the head E′, connected to or forming the terminal of pipe O, and which delivers the heated oil from the heating-tank,

and the series of flanged tubes or concentrically-arranged funnels E, which, being open at the rear, admit the air-supply for the burner.

I shall next describe the construction of the combustion-chamber, by which it is specially adapted for use with an injector in burning hydrocarbons, and for purposes of illustration I have shown the same (see Figs. 3 and 4) in connection with a boiler, but do not intend nor expect to be limited thereby.

T indicates the combustion-chamber, and H the door thereof, within which is inserted the injector, (see Fig. 2,) which delivers the hydrocarbon or liquid fuel. The form preferably given to the combustion-chamber is egg-shaped or oval in longitudinal section, the swell increasing inward from the door for about two-thirds the length of the chamber, and then gradually decreasing to the point T′, which forms the throttle or compression-point, where combustion should be complete. In cross-section the combustion-chamber T may be oval, round, or of other desirable form.

The walls X, inclosing the combustion-chamber, are formed hollow, as shown at P, in order to provide air-chambers, which communicate with the exterior, as at P^2, and deliver air to the combustion-chamber near the injector through the perforations P′ and at the throttle T′ through the perforations P^3. The ports P^2 may be provided with valves p', to regulate the amount of air admitted to the combustion-chamber. The walls of the combustion-chamber T, to obtain the best results, should be built of the best quality fire-brick, and preferably those which have been molded to the special shape.

It will be noted that owing to the peculiar construction of the combustion-chamber it will act with an injector on somewhat the principle of an Argand burner. The flame being fully supplied with air, combustion will be complete, and little or no smoke will be formed or soot deposited.

L represents the boiler, which is suspended by the ordinary boiler-lugs, *l l*, upon the walls N N, thus forming the flue I and front and rear chambers, K K′, the upper flue, I, being formed by the brick arch N′. The front and rear chambers, K K′, may be provided with doors A A, lined with fire-brick, and through which access may be had to the boiler-flues.

p indicates expansion-rollers placed beneath the rear end of the boiler L.

The devices, being substantially those before described, will operate as follows: The heating-tank may be filled through pipe B to any desired height, usually to within a few inches of the top. The valves being then closed, live steam is admitted to the tank through pipe S and heats the contents of the tank, vaporizing any of the hydrocarbons vaporizable at that temperature, and the steam and gas thus formed will rise to the top of the tank, exerting a pressure on the surface of the contained liquid. A portion of the steam will be condensed, and will, if the hydrocarbon used is lighter than water, be directed, (together with any dirt or sediment,) by the funnels F, to the bottom of the tank, whence the same can be withdrawn by the pipe V.

If the hydrocarbon used is heavier than the contained water or condensed steam, try-cocks *c* may be used.

When the contents of the tank become heated and a fire is needed, a slight fire may be started in the combustion-chamber T of the furnace, the valve on pipe R opened, which will supply the jet *r* with mixed steam and gas from the top of the heating-tank, and the valve on pipe O opened, which will allow the heated oil from the tank to enter the head E′, where it will be met by the jet of steam and gas and forced in the form of spray through the series of funnels or flanged tubes E, which induce the air-supply for the body of the flame, the exterior of the flame being amply supplied with heated air through the perforated hollow walls of the combustion-chamber.

It will be perceived that two forces are exerted in delivering the liquid fuel to the combustion-chamber—viz., the pressure of the steam and gas on the surface of the liquid in the tank and the action of the steam and gas through the jet. As before specified, the Argand form given to the combustion-chamber insures complete combustion.

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

1. The method herein described of supplying liquid fuel to furnaces, which consists in subjecting the liquid fuel in a closed supply-tank to the action of steam, whereby the liquid is heated and pressure is exerted on the surface of the liquid to force the same to an injector, and utilizing the mixed live steam and gas from the supply-tank to supply the jet of the injector and spray the liquid which has been forced to the jet by the pressure in the tank, substantially as specified.

2. The combination, with a furnace for burning liquid fuel, of an injector and a closed supply-tank, both connected with the jet and with the injector-head by pipes or tubes, and a steam-pipe for admitting steam to the supply-tank, substantially as and for the purpose specified.

3. The supply and heating tank provided with a series of funnels arranged therein, one above another, substantially as and for the purpose specified.

4. The supply and heating tank provided with a series of funnels arranged therein, one above another, and a steam-pipe coiled in the lower part of the tank, and extending up to and discharging in the upper part of the tank, substantially as and for the purpose specified.

5. In a furnace for consuming liquid fuel, a combustion-chamber having an egg shape (or oval in longitudinal section) and surrounded by hollow walls which are perforated, to ad-

mit air to the combustion-chamber, substantially as and for the purpose specified.

6. The combination, with an oval or egg-shaped combustion-chamber having hollow perforated walls, of an injector composed of a central jet, an inclosing shell or head, and a series of concentrically-arranged flanged tubes or funnels, substantially as and for the purpose specified.

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

DENNIS CHURCH.

Witnesses:
HENRY M. PIERCE,
MARY J. PIERCE.