

Jan. 22, 1935.

W. J. D. VAN DIJCK ET AL

1,988,673

APPARATUS FOR BURNING LIQUID FUEL

Filed Jan. 13, 1933

2 Sheets-Sheet 1

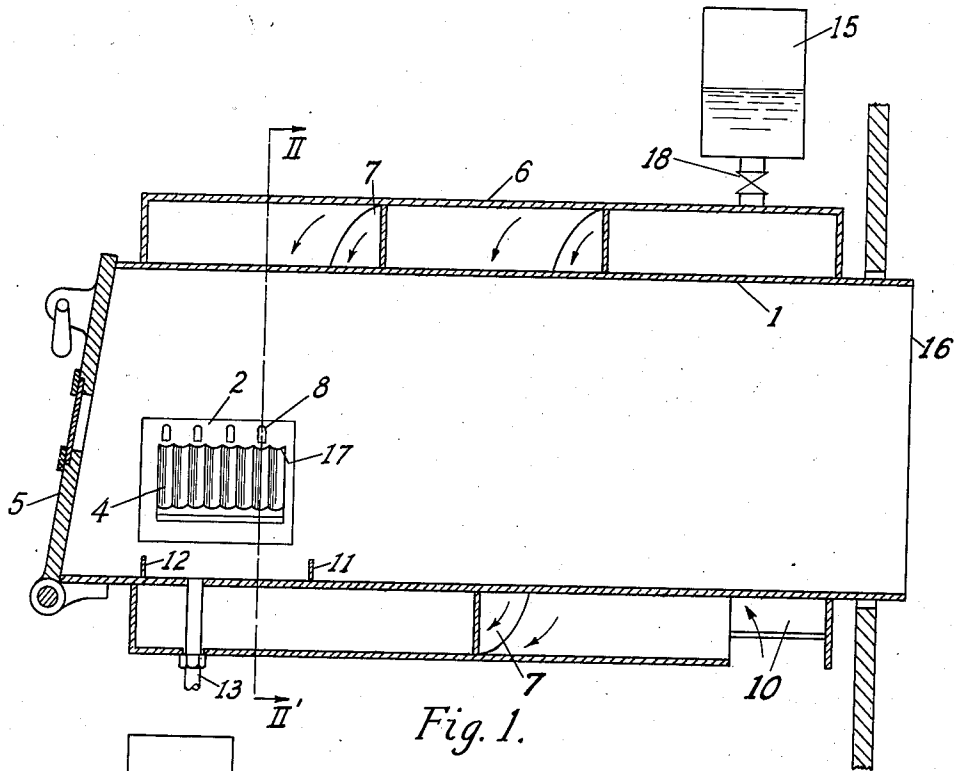


Fig. 1.

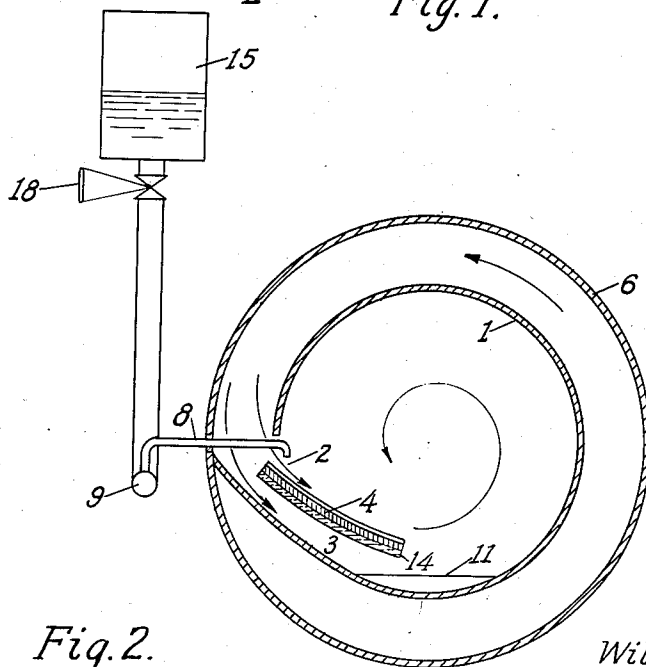


Fig. 2.

Inventors:
Willem J.D. Van Dijck
Adriaan M.I. Hoogendam
By their Attorney 

Jan. 22, 1935.

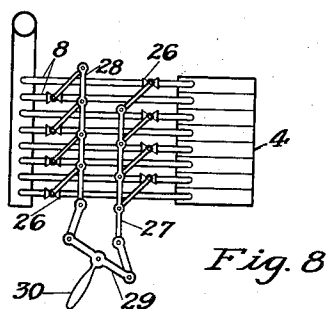
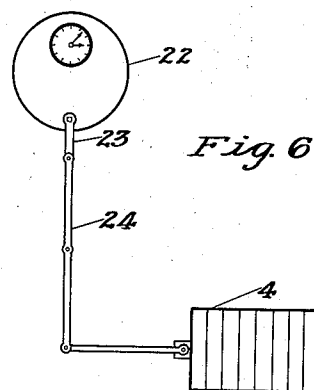
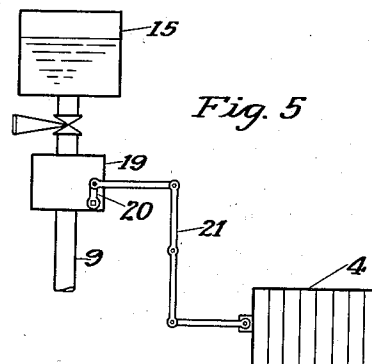
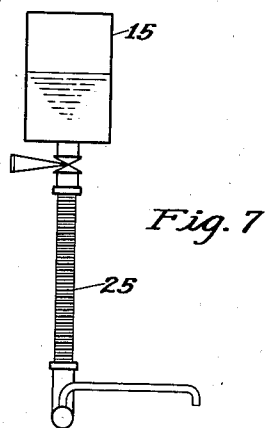
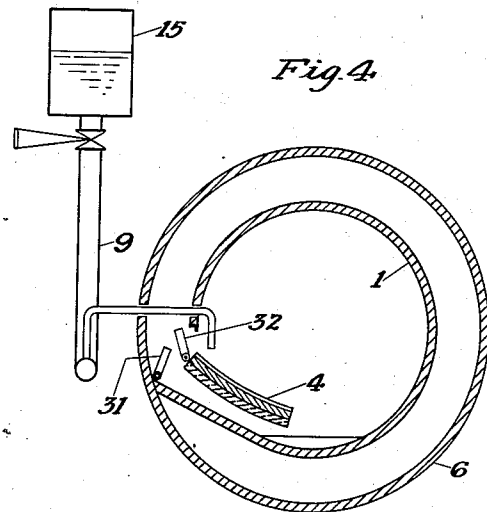
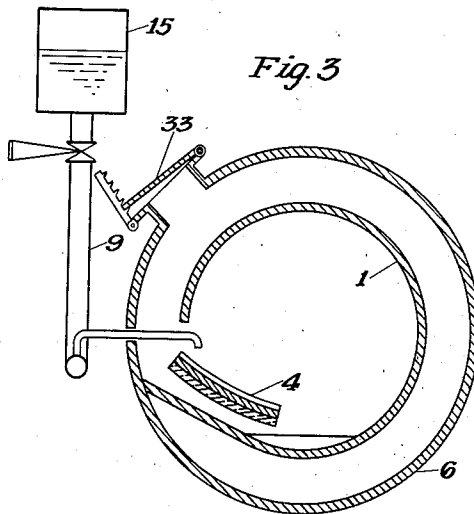
W. J. D. VAN DIJCK ET AL

1,988,673

APPARATUS FOR BURNING LIQUID FUEL

Filed Jan. 13, 1933

2 Sheets-Sheet 2



Inventors
Willem J.D. Van Dijck
Adriaan M.I. Hoogendam
by their Attorney *[Signature]*

UNITED STATES PATENT OFFICE

1,988,673

APPARATUS FOR BURNING LIQUID FUEL

Willem J. D. van Dijk, The Hague, and Adriaan
M. I. Hoogendam, Delft, Netherlands, assignors
to Shell Development Company, San Francisco,
Calif., a corporation of Delaware

Application January 13, 1933, Serial No. 651,540
In the Netherlands August 22, 1932

7 Claims. (Cl. 158—91)

This invention relates to burners of the vaporizing type and is particularly concerned with obtaining smokeless combustion with such burners.

5 In a recently devised process, liquid fuel in small amounts in a non-atomized state is brought into contact with heated air which has attained the required high temperature by being mixed with amounts of hot combustion gases. One
10 manner of carrying this process into effect includes passing air for combustion tangentially into a cylindrical combustion chamber, having a centrally located outlet for combustion gases. The fuel is supplied to a plate near the circular
15 wall of the chamber, and owing to the described arrangement the air and combustion gases follow a spiral shaped course within the chamber, causing a slight mixing of the combustion gases with the incoming air, so that the temperature of the
20 air is raised considerably before the air comes into contact with the liquid fuel.

It is an object of this invention to devise a means whereby a more complete combustion may be effected in apparatus of the above described
25 type.

Another object of this invention is to devise means in which a more intimate mixing of the air stream with the vaporized fuel is brought about.

30 We have found that for obtaining the desired smokeless combustion the currents of gaseous products emanating from the liquid fuel should be in contact, if possible, on all sides with heated air currents.

35 According to one feature of our invention the air for combustion is led immediately above and below the fire plate (upon which the liquid fuel is spread) in such a manner that the layer of gaseous evaporation and decomposition products
40 of the fuel is enclosed by layers of air. In addition to being heated by being mixed with the flame gases in the combustion chamber, this air may be preliminarily heated by causing it to flow along the outside of the combustion chamber.
45 The plate on which the fuel is spread may be divided into separate parallel strips separated by intermediate strips to which no fuel but only air is supplied, so that the current of evaporation and decomposition products form a strip
50 to which fuel is supplied, is surrounded on all sides by currents of air.

Other features of our invention will appear from the following description of apparatus incorporating our invention, throughout which de-

scription reference is made to the accompanying drawings, of which

Fig. I is a longitudinal section of the apparatus

Fig. II is a cross-section along the line II—II'

of Fig. I. Fig. III is a cross-section of a modified form of the apparatus having a damper for admitting unheated air. Fig. IV is a cross-section of a modified form of the apparatus having dampers for regulating the flow of air above and below the fire plate. Fig. V is an elevation of means for moving the fire plate after a predetermined amount of oil has flowed into the fire plate. Fig. VI is an elevation of means for moving the fire plate after a predetermined period of time has elapsed. Fig. VII is an elevation of means by which the fuel feed pipes may be moved laterally. Fig. VIII is a plan view of a fuel feed arrangement in which a fuel feed pipe is located over every groove of the fire plate.

Referring to the drawings (1) represents a cylindrical combustion chamber having an outlet for combustion gases (16) at one end, the other end of the chamber being closed by means of a hinged door (5) which can be opened for inspection, cleaning, and lighting. The air for combustion enters the chamber (1) through an inlet provided in its wall near the closed end of chamber (1). This inlet is divided into two openings (2) and (3) by means of a fire plate (4).

Concentric with the cylindrical combustion chamber (1) is mounted a second cylinder (6) of greater diameter. This cylinder is provided with end pieces so that a jacket-like space is formed between the walls of the two cylinders. The cylinder (6) has an opening (10) in its wall near the open end of the combustion chamber (1) so that the air for combustion enters the cylinder (6) tangentially and flows through the space between the walls of the two cylinders and in so doing is heated by being in heat exchange relationship with hot combustion gases flowing in opposite direction in the combustion chamber (1), moreover an excessive heating of the combustion chamber wall is thus prevented. In order to increase the rotating movement of the air, a helical guide plate (7) is fitted in the jacket space. The axial movement of the air in the jacket space is opposite to that in the combustion chamber (1) which helps to keep the course of the gases on entering the combustion chamber (1) in the shape of a screw with a comparatively flat pitch so that the flame is returned as much as possible over the fire plate (4). The fire plate has a number of parallel grooves (17). Above every second groove is located an oil conduit (8). The several

55

oil conduits (8) are connected to a common liquid fuel supply line (9). The fire plate (4) becomes very hot during working owing to radiation, and the relatively cold liquid fuel fed into the grooves (17) and flowing downward therein is almost immediately vaporized and gasified. The current of vapor and gas generated is entrained by the air moving above and below the plate and also through the adjacent grooves. A flame is produced by the combustion of the gaseous mixture formed. The hot combustion gases travel in a spiral direction around the cylinder axis causing the mixing of a part of the combustion gases with a part of the fresh air entering through the openings (2) and (3) so that a very hot oxygen containing gas is obtained which promotes a ready evaporation and combustion of the fuel when it comes into contact with it. The fire plate (4) is preferably so mounted in the combustion chamber that it can be moved laterally at least a distance equal to the width of one groove. The fire plate (4) may be provided on its lower face with a layer of insulation (14) consisting of asbestos board or other suitable material in order to prevent overheating of the plate.

When operating the above described apparatus with heavy oil, a residue consisting mainly of ash and carbon is often deposited upon the fire plate forming a hard crust thereon. This deposit can readily be removed from the plate by moving the plate laterally one groove width so that the grooves fouled by residue are no longer under the end of the fuel feed pipes (8) but are in an area where only hot air is flowing. If the plate is so moved, the deposit in these grooves will be soon burnt and the ash carried off with the flue gases rendering the grooves clean again. The lateral movement of the fire plate may be automatically regulated so that one set of grooves first receives oil and then after a predetermined amount of oil has been consumed or after a certain period of time has elapsed, the other set of grooves receives the oil. Specific means for carrying this into effect will be seen in Figures V and VI of the accompanying drawings. Referring to Fig. V an oil meter (19) is connected in the fuel line (9). This oil meter is provided with crank arm (20) arranged to move every time a certain amount of fuel has flowed through the meter. By means of linkage (21) the movement of crank arm (20) causes the fire plate (4) to move laterally. Referring to Fig. VI a timing device (22) provided with a crank arm (23) arranged to move after a predetermined period of time has elapsed is connected by linkage (24) to the fire plate (4) so as to cause lateral movement thereof.

Instead of providing a laterally movable fire plate we may make use of a set of laterally movable fuel feed pipes. This may be carried out in practice by making part of the fuel supply pipe of flexible material as shown at (25) in Figure VII. As a further alternative we may have a fuel feed pipe positioned over every groove of the fire plate arranged so that liquid fuel is discharged first from one set of alternative feed pipes and then from the other. A manner of carrying this into effect is shown in Fig. VIII in which each fuel feed pipe (8) is provided with a control valve (26). The control valves of one set of alternate feed pipes are connected to an operating bar (27) and the control valves of the other set of alternate feed pipes are connected to an operating bar (28). These bars are connected to a cross member (29) in such a manner that when one set of control valves is open the other set is closed.

By suitable movement of lever (30) it will be seen that liquid fuel will be discharged first from one set of the feed pipes and then the other.

Although it is hardly ever necessary to remove the fire plate (4) in order to clean it, it may be advantageous to mount it in the combustion chamber in such a manner that it is easily removable and interchangeable.

Both the fire plate and combustion chamber should preferably be made of special material, for instance, chrome nickel steel in order to resist high temperatures and corrosion.

On the bottom of the chamber a trough is formed by baffle plates (11) and (12). Unconsumed oil drips into this trough and is withdrawn through line (13), which may be used for actuating a signalling or safety device with the object of putting the burner out of operation until the defect causing such accumulation of oil is remedied.

The quantity of oil supplied to the plate (4) may be regulated by means of a needle valve (18) in the line (9) leading from supply tank (15).

The amount of oil supplied to the burner may be regulated automatically from the condition of the object to be heated, such as the temperature of the water or the steam pressure in the boiler of a central heating plant.

The quantities of air admitted to the burner may be regulated by making the air opening above and below the fire plate adjustable as will be seen from Fig. IV in which (31) is a damper for adjusting the amount of air flowing under the fire plate (4) and (32) a damper for adjusting the amount of air flowing over the fire plate (4). Furthermore it may sometimes be advantageous to provide adjustable openings for supplying unheated air to the combustion chamber as will be seen from Fig. III in which (33) represents an adjustable opening for admitting unheated air to the cylinder (6) near the closed end of the combustion chamber (1). When starting up the burner it has first to be preheated which may be done by supplying an easily inflammable liquid, combustible gas or solid fuel to the combustion chamber.

Numerous modifications of the apparatus are possible without deviating from the principle of our invention. For instance, the combustion chamber need not necessarily be cylindrical, but may be slightly conical, have an elliptical cross-section, or be curved longitudinally.

Furthermore a plurality of fire plates may be provided, either side by side or one above the other if desired with separation-walls therebetween. These may be used separately or together as desired.

The combustion gases may also be removed tangentially from the combustion chamber if desired.

We claim as our invention

1. Apparatus for burning liquid fuel comprising a substantially cylindrical combustion chamber, an inlet in the wall of said chamber, a fire plate in said chamber, a plurality of fuel supply conduits positioned above said fire plate, and means whereby the positions of the fire plate and the fuel supply conduits may be varied in relation to each other.

2. Apparatus for burning liquid fuel comprising a substantially cylindrical combustion chamber, an inlet in the wall of said chamber, a fire plate in said chamber, a plurality of grooves in said fire plate, fuel supply conduits positioned above each of said grooves of said

fire plate, and means whereby fuel may be supplied alternatively to the even numbered and odd numbered grooves of said fire plate.

5 3. Apparatus for burning liquid fuel comprising
a substantially cylindrical combustion chamber,
an inlet in the wall of said chamber, a horizontal-
ly moveable fire plate in said chamber, a plurality
of grooves in said fire plate, and fuel supply con-
duits positioned above every second groove of said
10 fire plate.

4. Apparatus for burning liquid fuel compris-
ing a substantially cylindrical combustion cham-
ber, a jacket surrounding said combustion cham-
ber, an inlet into said jacket, a tangentially di-
15 rected inlet from said jacket into said combustion
chamber, a fire plate in the combustion chamber
near the mid point of said tangentially directed
inlet, whereby air introduced to the combustion
chamber flows above and below said fire plate and
20 parallel to the surface thereof and a conduit for
supplying liquid fuel to the surface of said fire
plate.

5. Apparatus for burning liquid fuel as in claim
4, including means for imparting a rotary motion
to gases flowing through the jacket surrounding
the combustion chamber.

6. Apparatus for burning liquid fuel as in claim 5
4 including a helical guide plate in the jacket sur-
rounding the combustion chamber.

7. Apparatus for burning liquid fuel compris-
ing a substantially cylindrical combustion cham-
ber, a jacket surrounding said combustion cham-
ber, a conduit from said jacket into said cham-
ber, a fire plate in the chamber, a helical guide
plate in said jacket whereby the axial move-
ment of gases in said jacket is opposite to that
of gases in said combustion chamber and a conduit 15
for supplying liquid fuel to the surface of said
fire plate.

WILLEM J. D. VAN DIJCK.
ADRIAAN M. I. HOOGENDAM. 20