Sept. 3, 1935. W. FERGUSON 2,013,302

BURNING FLUID FUEL

Filed July 29, 1932

Fig. 1.

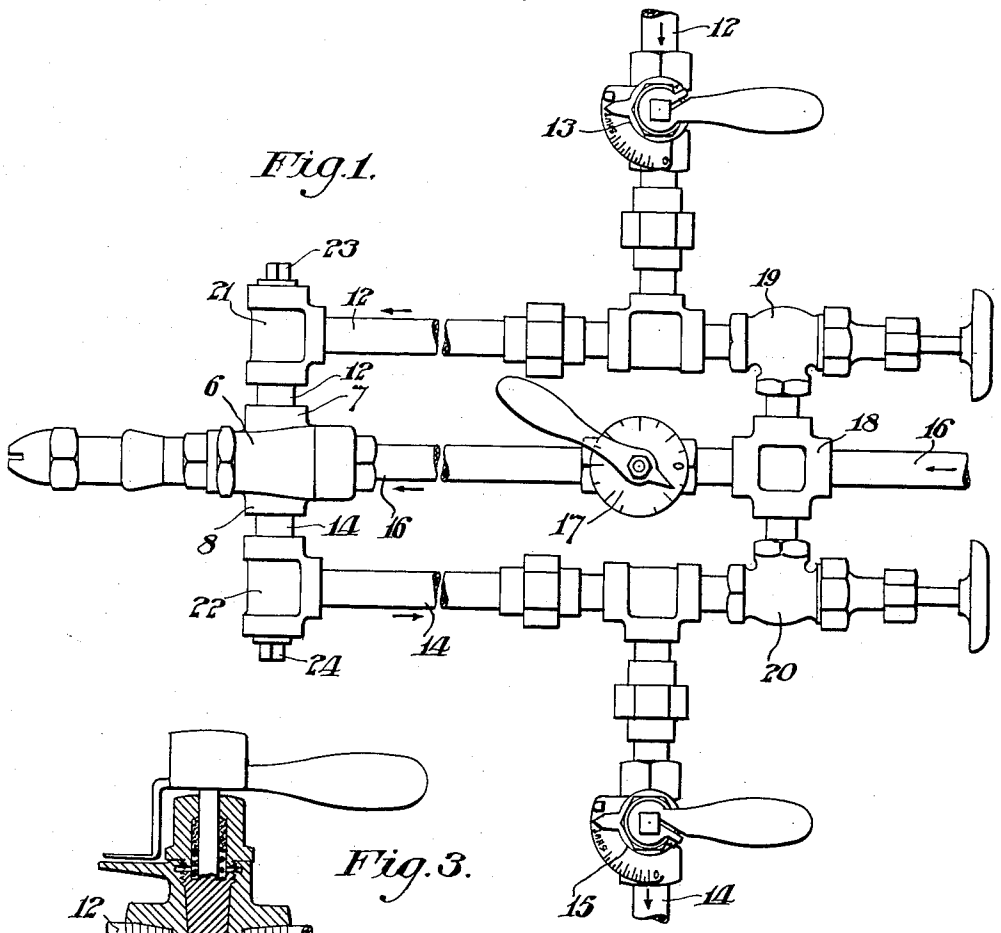
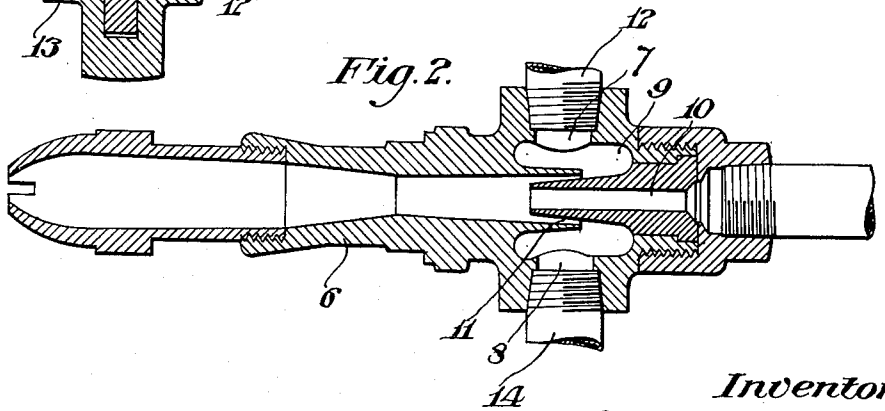


Fig. 3.

Fig. 2.



Inventor:
William Ferguson,
By Jno Coombs
Attorney.

Patented Sept. 3, 1935

2,013,302

UNITED STATES PATENT OFFICE

2,013,302

BURNING FLUID FUEL

William Ferguson, Philadelphia, Pa., assignor to National Airoil Burner Company, Incorporated, a corporation of Delaware

Application July 29, 1932, Serial No. 625,850

5 Claims. (Cl. 158—75)

This invention relates to improved method and means for burning fuel. The invention is especially applicable for burning such liquid fuels, commonly known as residue or refuse fuel oil, acid sludge or cokey fuel oil. There are several general grades of the residue fuel oil, for example a residue from cracking oils, which is a tarry or pitchy substance that has previously been exposed to a high temperature where destructive distillation has taken place, leaving this very viscous residue with large particles of free coke in suspension. Another grade is known as acid sludge, which is the product of acid treating tanks and contains some sulphuric acid, fuel oil and particles of coke. Another grade is similar to the acid sludge, except that the acid is neutralized with caustic. These oils may or may not be blended with a light volatile fuel oil.

In burning these refuse oils several difficulties are encountered, aside from the combustion problem. These difficulties especially relate to clogging the burner and also the regulating valve. The especial object of the present invention is to overcome these difficulties.

Referring to the drawing which illustrates merely by way of example suitable means for effecting the invention:—

Fig. 1 is a plan view of the burner with the pipes, connections and valves associated therewith.

Fig. 2 is a longitudinal section on an enlarged scale of the burner.

Fig. 3 is a sectional view also on an enlarged scale of an oil regulating valve.

Similar numerals refer to similar parts throughout the several views.

The burner or burner body 6 is of standard type except that it is provided with two ports instead of one as heretofore. Port 7 is the inlet port for liquid fuel, and port 8 an outlet or discharge port for said fuel or a part thereof. These ports 7 and 8 communicate directly with an annular chamber 9 in which the fuel delivered through port 7 is distributed evenly around the nozzle 10 so that it is supplied correctly through the annular passage 11, to the venturi, which delivers to the burner tip. This annular passage 11 is formed by the projection of the discharge end of the nozzle 10 into the oppositely projecting flange 24 which is integral with the body 6. The nozzle and flange are concentric and the periphery of the nozzle is spaced from the inner wall of the flange so that the fuel passing between them flows in a very thin annular film. The pipe 12, controlled by the regulating valve 13, delivers the fuel under pressure to port 7 of the burner, while pipe 14, controlled by regulating valve 15, conveys the surplus fuel from the burner back to the tank or other desired point. The pipe 16 is connected with a steam or compressed air supply or other atomizing agent and delivers through regulating valve 17 to the nozzle 10 of the burner in the usual way. A cross-connection 18 is provided in pipe 16 for connection with the clean-out valves 19 and 20. The connections between pipes 12 and 14, and the burner 6, also include the T's 21 and 22, which are provided with plugs 23 and 24. These plugs may be removed as occasion requires as hereinafter described.

In the fuel supply line 12 to the burner, a plug cock valve 13 of the type shown in Fig. 3, is used to regulate the amount of fuel oil going to the burner. This valve is adjusted according to the amount of fire required in the fire-box. In using high quality oil there is no difficulty with this control, but, in using any of the residues referred to, I have found that when the valve is adjusted for the flame volume required, the burner may operate satisfactorily for a short period of time, until a particle of coke enters this valve and clogs or entirely closes the valve opening. In such case it becomes necessary to open the valve sufficiently wide to pass the particle, and then change the adjustment back to the required capacity, until the valve again becomes clogged.

This difficulty may be partially overcome by decreasing the pressure of the oil entering the valve, which permits a wider opening of the valve, but, at best, this has not served entirely to overcome the trouble.

The next difficulty is with the burner. In this device the fluid fuel enters, as stated, through passage 7 to the annular chamber 9 in which it is distributed evenly around the nozzle 10, so that it may be supplied correctly to the venturi. I have found that in burning most residue fuels that, even though a particle of coke passes the regulating valve, it will lodge in the chamber 9 because it cannot pass into the small annular opening 11, communicating with the venturi, and in time the chamber 9 becomes entirely closed up with an accumulation of such particles, and the burner must be removed for cleaning.

Another difficulty which occurs in burning residue fuel oil is that these fuels, particularly when blended with light oils, have a tendency to break down when exposed to heat. Therefore if chamber 9 is exposed to the radiant heat of the furnace, the free carbon in these fuels tends to sep-

arate from the light volatiles, and coke will accumulate and fill up chamber 9, thus making it inoperative and necessitate removal for cleaning. This trouble is not so likely to be encountered when the burner is run at high capacity, because the flushing action of a large quantity of fuel oil prevents chamber 9 from becoming overheated, and also because a sufficient time element is wanting to form carbon. However, inasmuch as the burner must operate over a wide range of capacities, it will readily be seen that some means must be provided to overcome this difficulty.

As means for overcoming these difficulties I have provided the burner body with the chamber 9 having the two fluid ports 7 and 8 opening directly thereto. The port 7 is connected to the oil supply, and port 8 is for the discharge of surplus oil.

The flow of fuel oil directly to the chamber 9 of the burner comes through the regular fuel supply line 12, from pumps, tank, etc. not shown, and the discharge of part of the fuel from the burner chamber 9 may be returned to the tank. By this arrangement it will be noted that the passage from port 7 to port 8 is at all times unobstructed.

With this arrangement the regulating supply valve 13 may be opened two or three times as much as if the standard arrangement were used. This will insure the passing of large solid particles of coke through the valve, and the larger volume of oil passing to the burner will insure a high turbulence in the burner chamber 9, thus preventing any settling out of free carbon which may be in the fluid fuel. Also this flushing action will carry any large particles of coke right into and through the burner chamber 9 and then to the return line and back to the tank, thus preventing any large particles from accumulating in the burner.

With this arrangement, the amount of liquid fuel going to the burner tip proper and being burned, can be regulated by either one of the valves; the supply, or return, or both. The regulating oil valves 13 and 15 are substantially the same in construction and operation.

If it should, for any reason, not be desired to use this burner as a re-circulating burner, and still to make use of its coke freeing ability, then the return line may be open to the atmosphere, and periodically the supply oil valve 13 may be closed, and steam or other atomizing agent admitted to the supply pipe 12 by opening the valve 19, which will blow out any particles of coke which have lodged in the burner chamber 9 and discharge it through the return line to the atmosphere, or sewer, whichever is desired.

As another alternative, by closing valves 13 and 15 and removing either plug 23 or 24 and operating the proper clean-out valve 19 or 20, a similar cleaning out of the burner may be secured.

What I claim is:—

1. In a liquid fuel combustion system, the combination of a burner body having a chamber intermediate its two ends, said body having a fuel inlet port and a fuel discharge port opening directly to said chamber, independently operated means for controlling the flow to and the flow from said chamber and means delivering an atomizing agent for acting upon the fuel in the chamber and projecting a portion thereof from the chamber to the region of combustion.

2. In a liquid fuel combustion system, the combination of a burner body having a chamber intermediate its two ends, said body having a fuel inlet port and a fuel discharge port opening directly to said chamber on opposite sides thereof, independently operated means for controlling the flow to and the flow from said chamber and means delivering an atomizing agent for acting upon the fuel in the chamber and projecting a portion thereof from the chamber to the region of combustion.

3. In a liquid fuel combustion system, the combination of a burner body having a burner vent at one end and an annular chamber intermediate its two ends with a contracted throat from the chamber to the burner vent, said body having a fuel inlet port and a fuel discharge port opening directly to said chamber, whereby is provided means for unobstructed flow from port to port, independently operated means for controlling the flow to and the flow from said chamber and means delivering an atomizing agent for acting upon the fuel in the chamber and projecting a portion thereof from the chamber through said vent to the region of combustion.

4. In a liquid fuel combustion system, the combination of a burner body having a chamber intermediate its two ends, said body having a fuel inlet port and a fuel discharge port opening directly to said chamber, independently operated means for controlling the flow to and the flow from said chamber, means delivering an atomizing agent for acting upon the fuel in the chamber and projecting a portion thereof from the chamber to the region of combustion, and selective means for securing when required a flow of atomizing agent through said chamber and ports in either direction.

5. In a liquid fuel combustion system, the combination of a chambered burner body provided with a burner vent, said body provided with diametrically positioned ports for the inlet of fuel to and the discharge of fuel from said chamber, a fuel intake nozzle projecting into the chamber and connected to the burner vent, and a nozzle formation for delivering atomizing agent, projecting into said fuel intake nozzle, said nozzles positioned relatively to provide between them an annular channel with restricted inlet, centrally within said chamber, the parts arranged and associated whereby the radial flow of liquid fuel from one of said ports to the other, past said inlet, will serve to keep said inlet free from accumulations of solid particles.

WILLIAM FERGUSON.