Nov. 20, 1928. 1,692,349

F. A. QUIROZ ET AL

LIQUID FUEL BURNER

Filed April 9, 1926 2 Sheets-Sheet 1

Fig. 1.

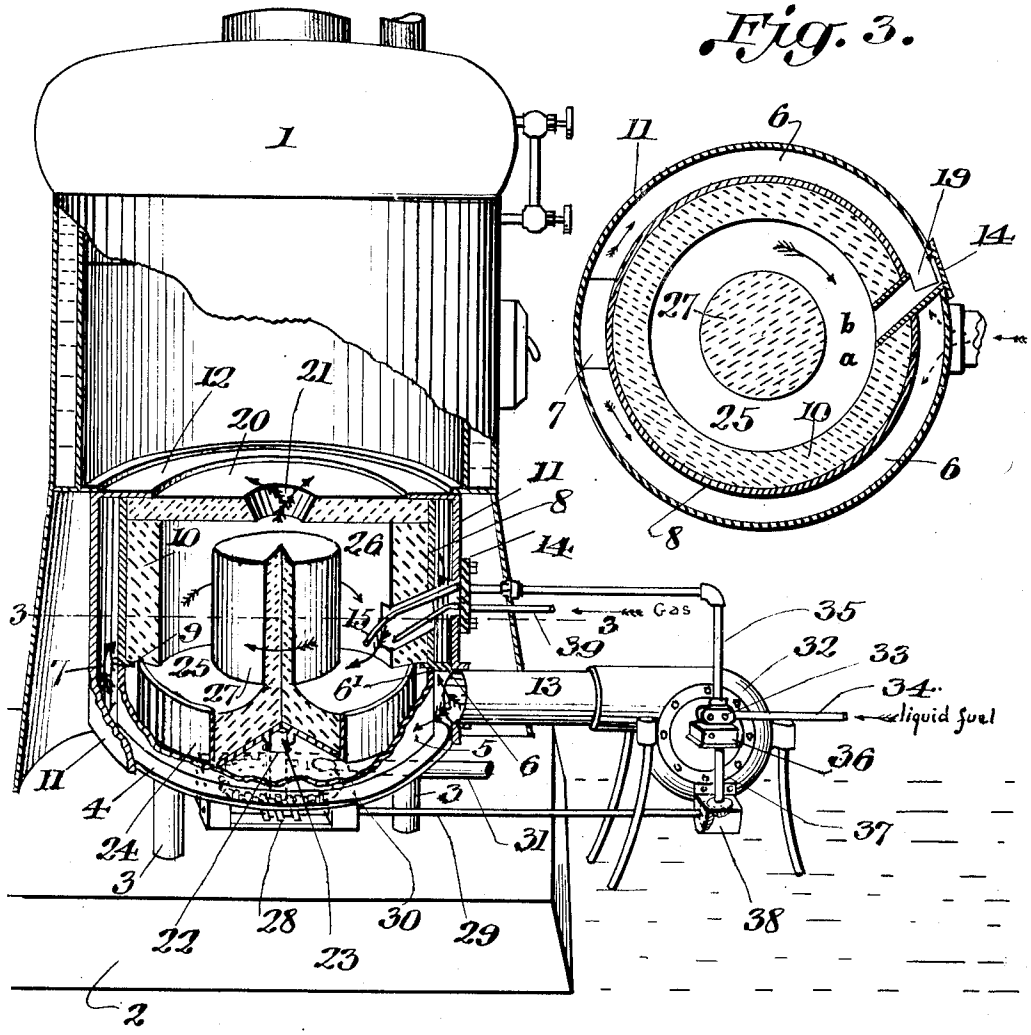
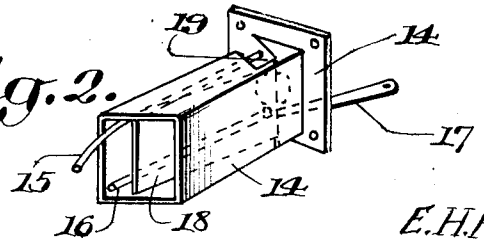


Fig. 3.

Fig. 2.



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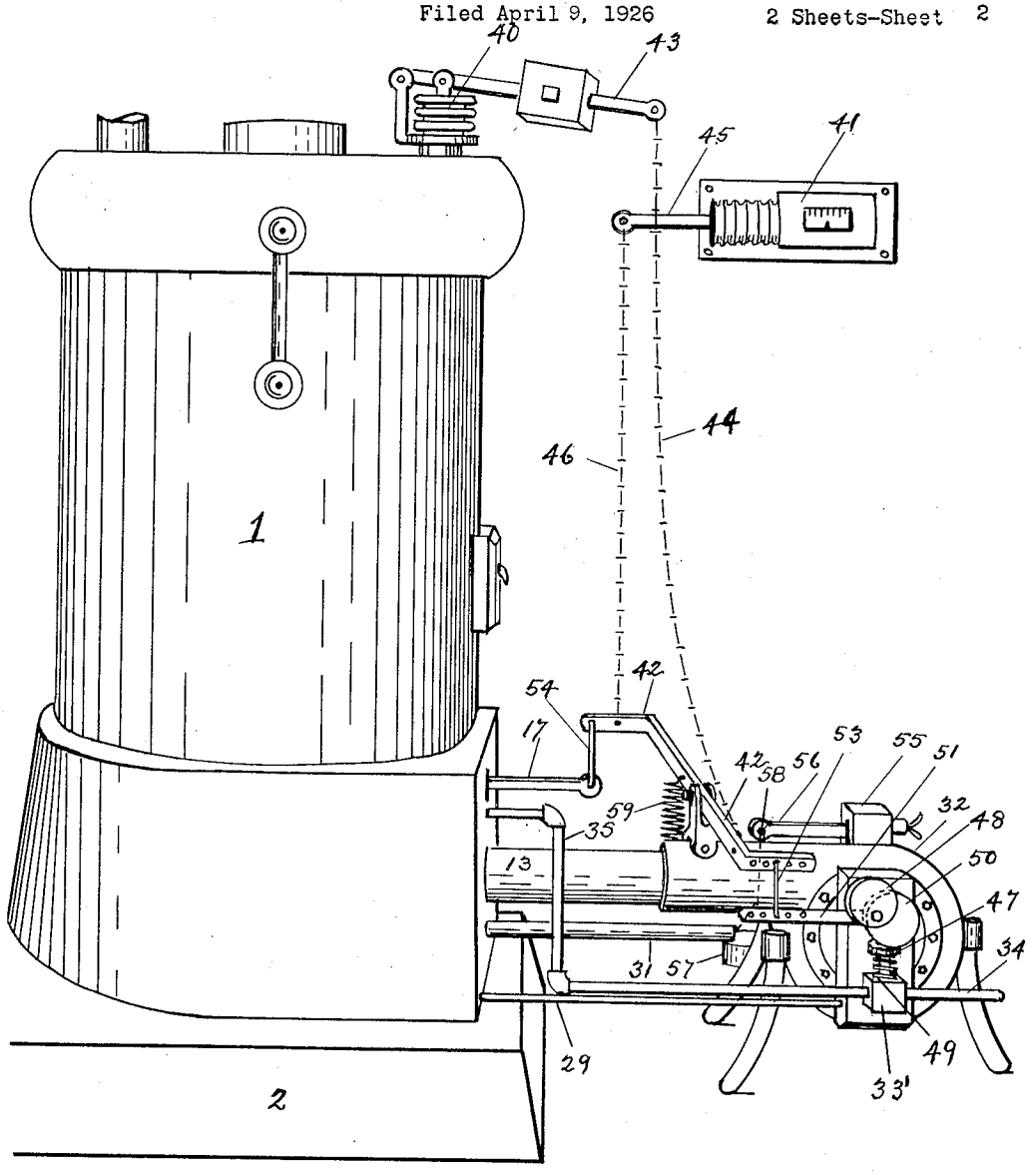


Fig 4.

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UNITED STATES PATENT OFFICE.

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LIQUID-FUEL BURNER.

Application filed April 9, 1926. Serial No. 100,838.

Our invention relates to liquid fuel burners, the object of which is to burn small amounts of liquid fuel of a character that cannot be sprayed or volatilized in small furnaces without forming a deposit of carbon, and to render such fuels suitable for domestic heating and other uses for small burners.

Another object of our invention is to provide a burner which will maintain a fire which may be varied over a wide range in combustion rate to suit the varying requirements of house heating.

A further object is to provide a burner which will automatically burn such carbon deposit as may be formed by the volatilization of the fuel.

These and other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings.

Figure 1—is a perspective view partly in section of our invention applied to a steam boiler.

Figure 2—is a perspective view of that part of the burner where the fuel and air are delivered to the furnace.

Figure 3—is a cross section along the line 3—3 Figure 1.

Figure 4—is a perspective view of the burner showing the device for controlling the rate of combustion.

Referring to Figure 1, the boiler 1 is supported on a suitable foundation 2 the space between the foundation and the boiler proper constituting the space devoted to the furnace. In this space is located the burner as constructed by us supported on suitable columns or legs 3. These legs fit into sockets (not shown in the drawing) in a base plate 4 which is provided with an extension 5 of cylindrical form, faced off evenly at the top. Superimposed on the casting 5 and properly centered by the counterbore 6′ is another casting 8 having an outwardly turned flange 6 at the bottom and an inwardly turned flange 9, the purpose of the latter being to support the refractory lining 10. The casting 8 is cylindrical in form and is evened off at the top to support another cylindrical casting 11 having a flange 12 at the top. This casting 11 extends down to the plate 4 and is so designed as to slip over the edge of the flange 6 and the plate forming a reasonably tight joint. The flange 6 does not extend entirely around the casting 8 but is cut away at the point 7.

The casting 11 is provided with an opening for the admission of air supplied through the pipe 13, this opening being near the bottom and on one side. Preferably on the same side and above, there is another opening to receive the casting 14 which is preferably made square in section, and which extends through a suitable opening in the casting 8 and through the refractory lining 10. This casting or box is closed at the front or outer end, except for some small openings for the oil feed pipe 15 and the gas pipe 16 and the handle 17 of the air damper 18. The box 14 is, however, open at the top and bottom and on one side as shown at 19.

When assembled, on the plate 4 with its extension 5, the combination of the four castings 4, 8, 11 and 14, forms a passage for air from the inlet 13 around the casting 5 (as shown by the dotted line arrows shown in Figure 3) to the opening 7, then up and back around casting 8 (as shown by the solid line arrows) to the opening 19 in the box 14. Thus a furnace chamber 26 is constructed, closed at the bottom by plate 4, with air cooled sides and with a lining of firebrick or other refractory material in the upper part. The top of this chamber is partially covered by a firebrick tile 20, in the center of which is placed a reduced opening 21 forming an outlet from the chamber at the top and in the center.

In the center of the bottom plate 4 there is an opening 22 through which may be inserted a shaft 23 which supports a rotatable pan or tray 24 of circular form and so designed that its upper rim will revolve with sufficient clearance under the overhanging firebrick wall 10 supported on the flange 9. The pan 24 may preferably be filled with a lining of refractory material 25 forming a fire resisting revolving floor for the chamber 26. Supported on this floor and revolving with it we construct a pillar or cylindrical column 27 of refractory material extending up under the top tile 20 under the opening 21.

The pan 24 supporting the floor 25 and the column 27 is carried and supported by the shaft 23 which in turn is supported and

revolved by a mechanism 28 driven by a shaft 29. Although not shown in the drawing a stuffing box may be provided where the shaft 23 passes through the opening 22, for preventing leakage of air or liquid. An opening 30 is provided in plate 4 communicating with a pipe 31 to take care of any overflow of liquid which may occur and this overflow of liquid may if desired be utilized to stop the supply of fuel, it being assumed that in normal operation no fuel would ever reach the plate 4 and its presence at that point thus indicating that the device was not functioning properly.

While it is understood that our invention will operate under natural draft conditions and with a gravity feed supply of fuel, we prefer to operate with forced draft and to deliver the fuel to the feed pipe by a pump.

One form in which these desired results may be obtained is shown in Figure 1. A motor (not shown) operates the blower which delivers the air under sufficient pressure to pipe 13. The shaft of the blower is geared to a pump 33 which draws liquid fuel from a source of supply (not shown) and delivers it under any desired pressure to the pipe communicating with the fuel feed pipe 15. The same gear 36 which operates the pump also drives the shaft 37 which through another suitable gear drives the shaft 29 which operates the gear 28 for rotating the pan 24. Thus the same motor which operates the blower drives the pump and rotates the pan.

The pipe 39 is for the purpose of supplying gas to a pilot light 16 which may be kept lighted continuously permitting an intermittent operation of the burner if desired. The motor driving the blower, etc., may, therefore, be alternately operated, and shut down, the burner operating alternately at full supply of fuel or none at all except for the pilot light.

In order to secure the variable rate of combustion desired it is necessary to provide other means for controlling the burner as shown in Figure 4.

Figure 4 illustrates the combustion control mechanism which automatically regulates the rate of combustion, in order to maintain a more or less predetermined temperature in the house or building to be heated.

The mechanism comprises a pressure regulator 40 which is connected to boiler 1. A thermostat 41 is installed in a convenient place in the house to be heated. A controlling lever 42 is connected to the pressure regulator lever 43 by means of a chain 44. The working lever 45 of the thermostat is also connected by means of a chain 46 to the opposite end of lever 42. A pump 33′ is installed in a convenient place on blower 32 so that it can be easily connected and be run by a projection in the shaft of the blower not shown. The pump 33 is a type of plunger pump. The plunger 47 is pressed down by means of a rotating eccentric 48 and is brought up by means of a spring 49. Thus it works up and down with a reciprocal movement. Another eccentric 50 is placed on the same shaft which causes eccentric 48 to rotate, but it works loosely on said shaft and has a lever 51 attached to its periphery in a convenient place so that such lever controls the means of increasing or decreasing the length of the stroke of plunger 47, and thereby the amount of fuel supplied by the pump 33. It is obvious that if the eccentric 50 is placed so that its maximum radius extends towards the plunger 47 it will press the plunger so far down that said plunger will be out of the way of the rotating eccentric 48 and no work will be accomplished by the pump, therefore it will cut off entirely the supply of fuel going into the burner, and the amount of fuel pumped into said burner will be in proportion to the position of eccentric 50 and lever 51. Lever 51 has at one end a plurality of holes 52 which match with the same number of holes on lever 51, the object of these holes being to permit a change in position of the connecting rod 53 and change the length of both levers. At the other end of lever 42 is connected by means of a rod 54 the controlling lever 17 of the damper which controls the amount of air supplied by the blower 32 through pipe 13. A spring 59 is connected to lever 42 to counterbalance the pull exerted by chain 44 and keep the oil and air closed off when the device is not working.

A cut off switch 55 which cuts off the electric current supplied to the electric motor (not shown) which runs the entire device is installed in a convenient place, this cut off switch having a controlling lever 56 to which a bucket 57 is attached by means of a chain 58. The overflow pipe 31 is placed so as to discharge into said bucket. The weight of the overflowing fuel which might fill the bucket 57 would pull down the lever of the cut off switch and the current would be cut off entirely causing the device to stop working.

To adjust the device for proper operation the rod 53 is placed in a position such that the amount of fuel pumped to the burner will be in synchronism with the amount of air allowed to pass by the damper. This is accomplished by moving the connecting rod 53 to the corresponding holes toward the loose eccentric or away from it as the case may be, thus increasing or decreasing the leverage on lever 51, till the fuel pumped to the burner is in proportion to the amount of air allowed to pass by the damper. The damper lever will remain in a fixed position in regard to the controlling lever 42, and the amount of air entering the burner will always be in proportion to the movement of lever 42. It is

obvious that if the amount of oil pumped is properly adjusted any proportions of oil and air may be secured.

The thermostat 41 is installed so that lever 45 moves down whenever the predetermined temperature is reached. This type of thermostat is well known and we have shown but a part of the mechanism included in it. Thus lever 42 will move down at the end which is connected to the air control and will reduce its supply, while the end connected to the oil control will move up and will cause the pump to reduce its stroke reducing thereby the amount of oil going into the burner; therefore the combustion in the boiler and the temperature in the room will decrease till the predetermined temperature is again obtained. If the temperature in the room drops instead of rising it is obvious that the opposite movement in the controlling levers will take place.

If the pressure in the boiler should rise above the safe point, then the pressure regulator 40 will lift the lever 43 and chain 44 which is attached to lever 42 will be pulled up and thus close off the oil and air supplied to the boiler till the pressure in said boiler drops to the safe point. The chain 44 is connected loosely so that it will not interfere with the movement caused by the thermostat lever 45 and lever 42.

A cut off switch 55 is installed in a convenient place. The lever 56 controls said switch by means of a bucket 57 which is attached to it by a chain 58. If it should happen that the fire in the burner should become extinguished for any reason and fuel should continue to be pumped into the burner, the fuel would overflow and come out through pipe 31 filling the bucket 57. The weight of the fuel in the bucket would then cause the lever 56 to cut off the electric current from the motor and stop the entire device.

In operation liquid fuel is delivered to the pipe 15 and dropped or sprayed onto the bottom 25 of the furnace chamber 26, which bottom portion together with the column 27 is being slowly revolved. We prefer to rotate the pan 24 carrying the furnace floor 25 and column 27 in the direction shown by the arrow 27′, but it may be made to move in the opposite direction if desired. Air for combustion enters at the point 13 and passes in both directions around the lower cylinder 5 up through the opening 7 and thence around the outside of cylinder 8 to the casting 14 through which it passes to the furnace, under the control and direction of the damper 18. Thus the furnace walls are kept cool and the pan is heated.

The casting 14 and the damper 18 are so arranged as to cause the air to enter the furnace space 26 and pass around the column 27, during which operation it comes into contact with the entering liquid fuel and immediately mixes with the volatile gases which have been distilled off under the influence of the heated walls of the furnace. The passages in the furnace are so proportioned that the air and resulting gases of combustion will assume a considerable velocity and pass around the column several times before gradually working up into the space above the column where they will continue to rotate and finally pass out through the orifice 21.

The rotation of these burning gases around the column 27 has a double effect; it lengthens the time and distance of travel in the furnace thus promoting complete combustion and it keeps the walls of the furnace chamber, including the walls of the column thoroughly heated up, thus promoting the distillation of the fuel and the complete combustion of all parts thereof.

When light distillates are used as fuel, such as kerosene and so called "furnace oil" the furnace chamber will be filled with burning gases and no deposits or residue from distillation will be deposited on the revolving floor. But if the heavier fuel oils should be used, the volatile matter will easily be driven off and burned, but a deposit of tarry matter or carbon will accumulate on the furnace floor. This deposit will be gradually carried around the circle by the rotation of the floor, and during this slow passage it will be exposed to the high temperature of the furnace walls and, in immediate contact overhead, to a stream of intensely hot gases containing an excess of air which is available for supplying oxygen, so that as it moves, the deposit is gradually consumed and in normal operation no trace of it remains by the time the rotation is completed. There is no special reason why the deposit may not make a second revolution through the furnace or indeed remain there until it is naturally consumed. However, the supposition is that it will disappear before reaching the point where new fuel is admitted, and we employ a special arrangement for securing this effect. It will be noted that the fuel feed pipe 15 projects beyond the end of the air inlet casting 14 so that fresh air unmixed with any other gases is projected onto the column and furnace floor at a point (see *b* Figure 1) in advance (as referred to the path of rotation) of the point *a* where the fuel is admitted. This fresh air supply plays directly on any remaining carbon and completes the combustion.

We have found some advantage in admitting the fuel at a point directly in the current of incoming air, as in this way it is sprayed out and distributed. Also at low rates of combustion when the damper is partly closed we prefer to direct the air close in to the column 27 where the heat of the column assists in maintaining the desired temperature.

We have described our invention in the preferred form but it may be greatly modi-

fied without departing from the spirit of our invention.

We claim as our invention:

1. In a liquid fuel burner, a combustion chamber, a rotary table at the bottom of the chamber upon which the fuel is fed, said table carrying a central abutment for reflecting the heat, means at one side of the chamber for feeding fuel with an admixture of air to the table, said chamber having a discharge opening so placed with respect to the abutment that the burning gases are constrained to move above the abutment toward the discharge opening.

2. In a liquid fuel burner, a combustion chamber, a rotary table at the bottom of the chamber upon which the fuel is fed, said table carrying a central abutment for reflecting the heat, means for feeding fuel with an admixture of air at one side of the table, said casing having an axial discharge opening at the top, the top of the abutment so related to the opening as to constrain the burning gases to move toward the discharge opening.

3. In a liquid fuel burner, a combustion chamber, a rotary table at the bottom of the chamber upon which the fuel is fed, said table carrying a central abutment for reflecting the heat, means at one side of the chamber for feeding fuel with an admixture of air to the table, said chamber having a discharge opening so placed with respect to the abutment that the burning gases are constrained to move above the abutment toward the discharge opening, a blower for delivering air to the chamber, a pump for supplying fuel, a common motor for operating the blower and the pump, a drip pan for receiving liquid fuel from the chamber and means controlled by a selected weight of fuel in the pan for stopping the motor.

4. In a liquid fuel burner, a combustion chamber, a table supported within said chamber, a pillar mounted on said table, means to rotate said table and pillar, and means for feeding fuel and air for combustion to said chamber above said table, said chamber having a discharge opening so placed with respect to the pillar that the burning gases will flow above the pillar toward said opening.

5. In a liquid fuel burner, a combustion chamber with concentrically arranged walls spaced apart, a table supported within said chamber and means to rotate the same, a pillar mounted on said table, an oil feed pipe for delivering oil to said table, and means for admitting air to the space between said walls and from said space to the combustion chamber, said chamber having a discharge opening so placed with respect to the pillar that the burning gases will flow above the pillar toward said opening.

6. In a liquid fuel burner, a combustion chamber having a base, concentric walls supported upon said base, a partition separating the space between said walls into lower and upper compartments, means for admitting air into the lower of said compartments, said partition having an opening to permit the flow of air from the lower to the upper compartment and from the latter to the combustion chamber, a table supported within said chamber, a pillar mounted on said table, means to rotate said table and pillar, and means for admitting oil to the combustion chamber.

7. In a liquid fuel burner, a combustion chamber, a table supported within said chamber, a pillar mounted on said table, means to rotate said table and pillar, means for feeding fuel and air for combustion to said chamber above said table, said chamber having a discharge opening so placed with respect to the pillar that the burning gases will flow above the pillar toward said opening, and a pressure regulator for controlling the supply of fuel and air.

In testimony whereof we affix our signatures.

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