

Oct. 7, 1941.

K. P. BRACE

2,258,043

LIQUID-FUEL BURNER

Filed June 9, 1939

2 Sheets-Sheet 1

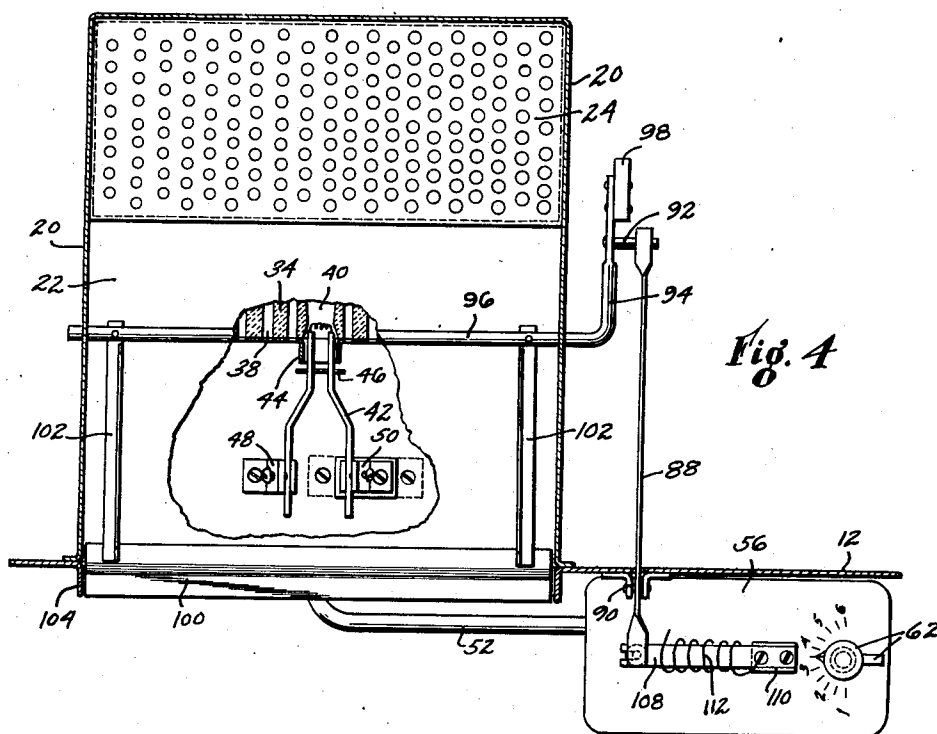


Fig. 5

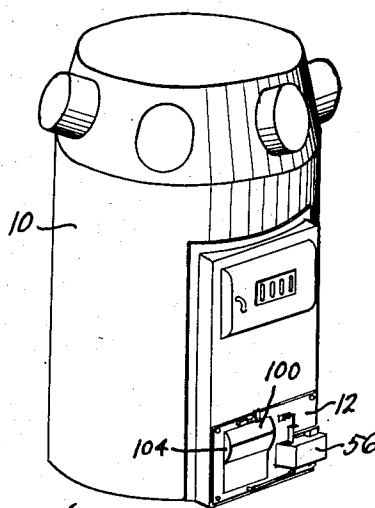
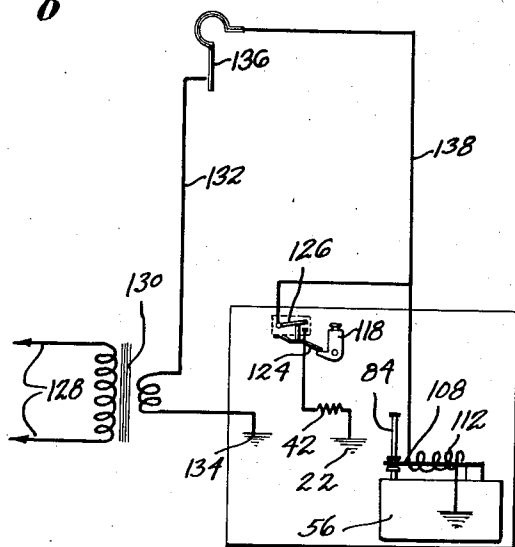


Fig. 1

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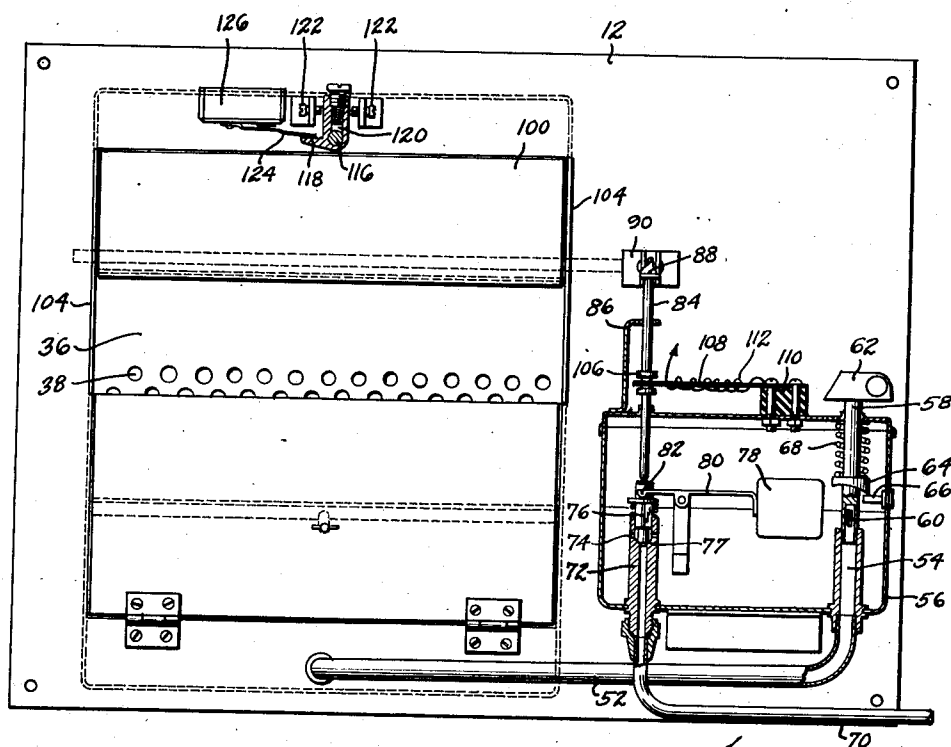
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UNITED STATES PATENT OFFICE

2,258,043

LIQUID-FUEL BURNER

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Application June 9, 1939, Serial No. 278,245

11 Claims. (Cl. 158—91)

This invention relates to burners, especially those of the conversion type, used in furnaces intended for household heating.

An object of the invention is to provide such a burner with a fuel supply that cannot overflow. Another object of the invention is to provide a burner of this type with means for automatically by-passing the air supply around the fuel and air mixing device when the burner is turned off. Preferably this is accomplished by a damper which has an intermediate position in which it supplies air, in starting, only to a portion of the mixing device which is adjacent an igniter.

The burner is illustrated herein as provided with a fuel pan, into which dips the lower end of a refractory member of porous structure, upwardly through which the fuel seeps by capillary attraction, and which has passages therethrough for the air. Thus if the burner should go out while the fuel is turned on, all that would happen is that the porous member would become saturated with fuel.

Various features of novelty relate to controlling the level of the fuel by a float mechanism or the like in a fuel reservoir, to providing the reservoir with means for adjusting the fuel feed, to correlating the movements of the float mechanism and the air-controlling damper by connecting them to the same novel control device, and to various other novel combinations and desirable constructions which will be apparent from the following description of the illustrative embodiment shown in the accompanying drawings, in which:

Figure 1 is a perspective view of a furnace embodying my invention in the form of a conversion burner;

Figure 2 is an enlarged front elevation of the burner, broken away in vertical section through the fuel reservoir;

Figure 3 is a vertical section through the burner in a plane perpendicular to the furnace wall;

Figure 4 is a horizontal section on the line 4—4 of Figure 3; and

Figure 5 is a wiring diagram.

The invention is shown in Figure 1 as embodied in a conversion burner mounted in place of the usual ash-pit door of a furnace 10, the door opening being closed by a front plate 12 which carries the burner parts. Top, bottom, rear, and side plates 14, 16, 18, and 20 secured to each other and to the plate 12 in effect form a burner casing projecting into the lower part of the furnace.

Within the casing so formed there is a hori-

zontal partition, the front part of which is in the form of a plate 22 and the rear part of which is in the form of a perforated block 24 of refractory ceramic material. The plate 22 serves as a separator to define two wide rectangular air openings 26 and 28 in the front plate 12.

Below the block 24 is a large transverse block 30 of ceramic material which protects the burner from the direct heat of the furnace. This block does, however, itself become highly heated, and aids in the heating of the fuel. Just above this block 30 is arranged a shallow fuel pan or receptacle 32, the front part of which is continued forwardly as a horizontal separator paralleling the plate 22, and which is secured to the front plate 12 below the opening 28.

Arranged in the fuel pan 32 is a fuel and air mixing device, preferably comprising a porous block 34 of refractory ceramic material, in which fuel from the pan 32 rises by capillary attraction. The block 34 is secured to the rear face of a vertical plate 36 which extends between the plate 22 and the front end of the fuel pan 32. Parallel horizontal passages 38 are formed through the plate 36 and block 34, so that all of the air drawn through the opening 28 by the suction from the stack of the furnace has to pass through these passages, where the fuel is taken up by and mixed with the air.

One of the air passages is in the form of a venturi 40 and the burner is provided with a hot wire igniter 42 extending into the front end of this passage. A collar 44 on the plate 36, at the front of which is a baffle washer 46 of mica or other insulating material mounted on the legs of the igniter 42, serves to provide considerable turbulence in the air entering the passage 40. One leg of the igniter is grounded to the plate forming the front of the fuel pan 32, by being mounted in a metal clamp 48; the other is mounted in an insulating clamp 50. Both of the clamps permit adjustment of the igniter toward and from the block 34.

A conduit 52 opens at one end into the bottom of the fuel pan and at its other end is connected to a standpipe 54 projecting upwardly into a fuel reservoir 56. A rod 58, reciprocable vertically in the top of the reservoir, is bored out from its lower end to form a downwardly-facing recess, the wall of which telescopically engages with the top of the standpipe 54.

This wall is formed with a vertical slot 60 forming the intake opening for the fuel passage leading by way of the conduit 52 to the fuel pan 32. Thus by raising and lowering the rod 58, more

or less of the slot 60 will be above the upper end of the standpipe 54, thus regulating the flow of fuel.

If the reservoir 56 contains fuel above the top of standpipe 54, the level in the pan 32 will be the same as in reservoir 56, except as lowered by resistance to flow of passage 60 and conduit 52, and as lowered by the drawing of the fuel upwardly through the block 34 and by its admixture with the air drawn through the passages 38.

In the arrangement illustrated, rod 58 is raised and lowered by turning a handle 62 to cause different parts of a face cam 64 to engage a stop pin 66. A spring 68 urges the cam against the pin.

Fuel is supplied to the reservoir 56 from any suitable source, for example flowing by gravity through a conduit 70 connected to the bottom of a standpipe 72 in the reservoir. At the top of the standpipe 72 are cross fuel passages 74, slightly above the level of the top of the standpipe 54. Fuel is admitted to these passages and thus to the reservoir by a needle valve 76, urged upwardly by a suitable spring from a valve seat formed in the standpipe 72 by a shoulder 77, and closed when the fuel rises to a predetermined level by a pivoted float 78. The float 78 is mounted on one end of a pivoted lever 80, the other end of which is provided with a head 82, flat on the top and rounded on the bottom to engage the head of the needle valve 76.

A vertical plunger 84 guided by an opening in the top of reservoir 56 and by a bracket 86, has its rounded lower end engageable with the head 82, and is arranged in line with the valve 76. Thus if the plunger 84 is forced downwardly the fuel supply will be shut off regardless of the float 78.

The upper end of the plunger 84 engages the flattened lower surface of one end of a pivoted horizontal lever 88, pivoted near its front end on a bracket 90 carried by the plate 12, so that the movement of its rear end is considerably amplified. The rear end of this lever is twisted to provide a flat lower surface engaging a pin 92 carried by the rearwardly-extending arm of a damper lever 94 bent to provide a pivot rod 96 journaled in the side plates 20.

The rear arm of this lever is provided with a counterweight 98 almost balancing a curved damper plate 100 secured by arms 102 to the pivot rod 96. A slight unbalance is left so that the damper always seeks its lowermost position but may be raised by a very small force. The lower end of the damper plate 100 is flanged to engage the front edge of the plate 22, to determine the upper position of the damper with air passage 28 open and passage 26 closed.

The arms 102 engage the plate 22 to determine the lower position of the damper, in which passage 26 is open and passage 28 is closed. Plate 12 may have plates or flanges 104 (Figure 1) to close off the spaces at the ends of the above-described swinging damper.

The plunger 84 carries abutments 106 embracing between them the forked end of a bimetal strip 108 mounted at its opposite end on a bracket 110. A coil 112 of resistance wire serves, when energized, to heat the strip 108, thus providing a convenient remote control for the plunger 84. This coil 112 is grounded at one end to the fuel reservoir 56.

Above the block 24 is arranged a thermostat such as a helix 114 of bimetallic material secured at one end to the top plate 14 and secured at its

other end to a shaft 116 which extends out through the front plate 12. A lever block 118 is frictionally mounted on the front end of the shaft 116, being yieldingly clutched thereto by a spring-backed clutch block 120. The upper end of the lever block 118 is movable between two adjustable stops such as set-screws 122. Any movement of the shaft 116 after the lever block 118 engages one of these stops merely causes the lever block to slip on the shaft.

The lever block 118 engages a leaf spring 124 arranged to operate any suitable standard commercial single-throw switch 126.

Figure 5 shows a preferred wiring diagram. Current from 110 volt lines 128 is stepped down in a transformer 130, the secondary of which is connected in a line 132 extending from ground 134 to a standard room thermostat 136 arranged in the space to be heated, and opening and closing electrical contacts at predetermined room temperatures.

This opens and closes a circuit through a line 138 connected in parallel through: (1) switch 126, igniter 42, and ground 22; and (2) coil 112 to ground 56. When the thermostat 136 first closes these circuits, the igniter 42 draws so much current that coil 112 only heats up enough to cause sufficient distortion of the bimetal blade 108 to allow the fuel valve 76 to open, and to raise the damper 100 to an intermediate position, in which passage 28 is only partly opened, thus allowing the igniter 42 to light the fuel taken up by the air passing through the passage 40 under conditions similar to those in starting an automobile engine with the choke pulled out.

As soon as the burner is ignited, heat rising through block 24 acts on the thermostat 114 to turn the shaft 116 to open the switch 126. Further heating of the thermostat 114 only causes the shaft 116 to turn idly in the lever block 118.

Since all of the current now passes through the coil 112, the bimetal blade 108 is quickly distorted to raise the damper 100 to its upper position, with the passage 28 open and the passage 26 closed.

The burner is now in normal operation. Air is drawn by the stack suction through the passages 28 and 38, taking up fuel and burning in the rear ends of the passages 38 and in the space behind the porous block 34. It will be noted that the cold incoming air during this stage of the operation effectively cools the igniter 42.

During this normal operation, the float mechanism 76—82 maintains a constant fuel level in the reservoir 56. The level is almost the same in the fuel pan 32, but is lowered slightly as the fuel is drawn up through the block 34, and due to the liquid friction in the passage 60 and the conduit 52. The further down the rod 58 is adjusted, of course, the slower the fuel is fed to the pan 32 and the lower the level drops in that pan.

When thermostat 136 opens the circuit, blade 108 cools and closes the fuel valve 76 almost immediately. There is still, however, a considerable amount of fuel in the fuel pan 32 and in the block 34, and a small amount in the reservoir 56 above the top of the standpipe 54. It has been found that if this fuel is burned with free passage of air through the passages 38, toward the end the incoming air cools the block 34 so much that carbon is deposited. Since the small amount of carbon always forms during normal operation the total effect would be to rapidly plug all the air passages.

By the above-described arrangement, however, during this period the damper 100 is gradually

lowered by the cooling of the blade 108, so that the final burning of the fuel is accomplished by air passing through passage 26 and down through block 24, with passage 28 closed. This permits the block 34 to get much hotter than it does during normal operation (since no air passes through it to cool it), effectively preventing the deposition of carbon as well as causing the carbon which has previously formed during normal operation to burn off.

As soon as air in any volume begins to flow through the passage 26, it cools the thermostat 114 and immediately closes the switch 126. Further cooling merely causes the shaft 116 to turn idly in the block 118.

It will be noted that if anything goes wrong, and the burner goes out, the worst that can happen is that pan 32 may contain fuel, but not enough to overflow. If the burner thereafter comes on, no harm is done, as the fuel will merely ignite and burn in the usual manner.

While one illustrative embodiment has been described in detail, it is not my intention to limit the scope of the invention to that particular embodiment, or otherwise than by the terms of the appended claims.

I claim:

1. A burner comprising a fuel pan, a porous refractory member formed with air passages therethrough and having its lower portion extending into said pan, means for supplying fuel to a predetermined level in said pan, a damper movable to one position in which it prevents the passage of air through said passages and permits air to be diverted around the porous member and to another position in which it opens said passages, and means for turning on the fuel supplying means and moving said damper to said other position and for turning off the fuel supplying means and moving said damper to its said one position.

2. A burner comprising a fuel pan, a porous refractory member formed with air passages therethrough and having its lower portion extending into said pan, means for supplying fuel to a predetermined level in said pan, and a damper movable to one position in which it prevents the passage of air through said passages when the fuel supplying means is turned off and which damper permits air to be diverted around the porous member and to another position in which it opens said passages when the fuel supplying means is turned on.

3. A burner comprising a fuel pan, a porous refractory member formed with air passages therethrough and having its lower portion extending into said pan, means for supplying fuel to a predetermined level in said pan, and a damper movable to one position in which it prevents the passage of air through said passages and permits air to be diverted around the porous member and to another position in which it opens said passages.

4. A burner comprising a fuel pan, a porous refractory member formed with air passages therethrough and having its lower portion extending into said pan, means for supplying fuel to a predetermined level in said pan, a damper movable to one position in which it prevents the passage of air through said passages and permits air to be diverted around the porous member and to another position in which it opens said passages, and means for turning on the fuel supplying means and moving said damper to said other position and for turning off the fuel supplying

means and moving said damper to its said one position, together with an igniter which is turned on when the fuel supplying means is turned on and which is turned off after ignition of the fuel, said damper having an intermediate position partially opening said passages when the igniter is on.

5. A burner comprising a fuel pan, a porous refractory member formed with air passages therethrough and having its lower portion extending into said pan, means for supplying fuel to a predetermined level in said pan, and a damper movable to one position in which it prevents the passage of air through said passages and permits air to be diverted around the porous member and to another position in which it opens said passages, together with an igniter which is turned on when the fuel supplying means is turned on and which is turned off after ignition of the fuel, said damper having an intermediate position partially opening said passages when the igniter is on.

6. A burner comprising fuel and air mixing means and fuel supplying means therefor, means for supplying air directly to the mixing means when the fuel supplying means is turned on and for diverting the air around the mixing means when the fuel supplying means is turned off, and an igniter which is turned on when the fuel supplying means is turned on and which is turned off when the fuel ignites, said air-supplying means having an intermediate position when the igniter is on, in which it supplies part of the air directly to the mixing means and the remainder around the mixing means.

7. A burner comprising a fuel pan having an air and fuel mixing device associated therewith and receiving fuel therefrom by capillary action, a fuel reservoir connected to said pan by a conduit, a fuel line, float mechanism connecting the fuel line to the reservoir and adapted to maintain a predetermined fuel level in the reservoir, a damper movable from one position in which it permits the passage of air to said mixing device to another position in which it blocks passage of the air to the mixing device and causes the air to pass around the mixing device, and a control connected to the float mechanism and to the damper and operating them synchronously.

8. A burner comprising a fuel pan having an air and fuel mixing device associated therewith and receiving fuel therefrom by capillary action, a fuel reservoir connected to said pan by a conduit, a fuel line, float mechanism connecting the fuel line to the reservoir and adapted to maintain a predetermined fuel level in the reservoir, a damper movable from one position in which it permits the passage of air to said mixing device to another position in which it blocks passage of the air to the mixing device and causes the air to pass around the mixing device, and a control connected to the float mechanism and to the damper and operating them synchronously, said control including a bimetallic strip and electrical means for heating said strip to cause it to operate the damper and float mechanism in one direction.

9. A burner comprising a fuel pan having an air and fuel mixing device associated therewith and receiving fuel therefrom by capillary action, a fuel reservoir connected to said pan by a conduit, a fuel line, float mechanism connecting the fuel line to the reservoir and adapted to maintain a predetermined fuel level in the reservoir, a damper movable from one position in which it permits the passage of air to said mixing device

to another position in which it blocks passage of the air to the mixing device and causes the air to pass around the mixing device, and a control connected to the float mechanism and to the damper and operating them synchronously, said damper having an intermediate position in which it permits passage of a portion only of the air to the mixing device and said burner having an igniter associated with the mixing device.

10. A burner comprising a fuel pan having an air and fuel mixing device associated therewith and receiving fuel therefrom by capillary action, a fuel reservoir connected to said pan by a conduit, a fuel line, float mechanism connecting the fuel line to the reservoir and adapted to maintain a predetermined fuel level in the reservoir, a damper movable from one position in which it permits the passage of air to said mixing device to another position in which it blocks passage of the air to the mixing device and causes the air to pass around the mixing device, and a control connected to the float mechanism and to the damper and operating them synchronously, said damper having an intermediate position in which

it permits passage of a portion only of the air to the mixing device and said burner having an igniter associated with the mixing device and having thermostatic means controlled by rising temperature above the pan to turn off the igniter.

11. A burner comprising fuel and air mixing means and fuel supplying means therefor, means for supplying air directly to the mixing means when the fuel supplying means is turned on and for diverting the air around the mixing means when the fuel supplying means is turned off, and control means interconnecting the fuel supplying means and the air supplying means for turning on the fuel supplying means and moving the air supplying means to an intermediate position for igniting in which a diminished supply of air is supplied to the mixing means and the remainder of the air is diverted around the mixing means and for thereafter moving the air supplying means to a position in which all of the air is supplied directly to the mixing means when the burner is ignited.

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