April 15, 1952 H. S. HILL 2,592,568

METHOD AND APPARATUS FOR PRETREATING LIQUID FUELS

Filed Oct. 12, 1949 3 Sheets-Sheet 1

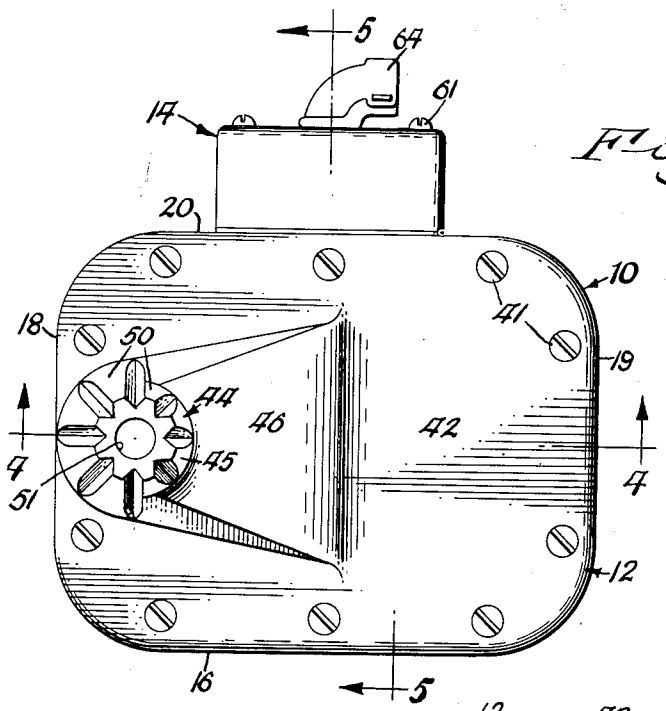


Fig. 1.

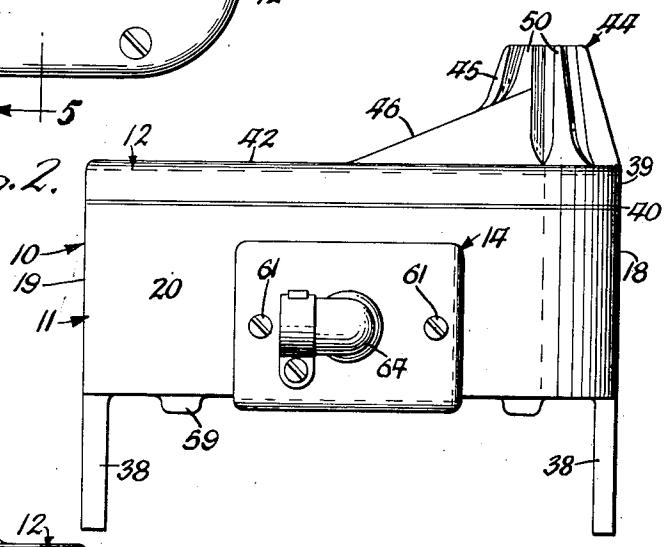


Fig. 2.

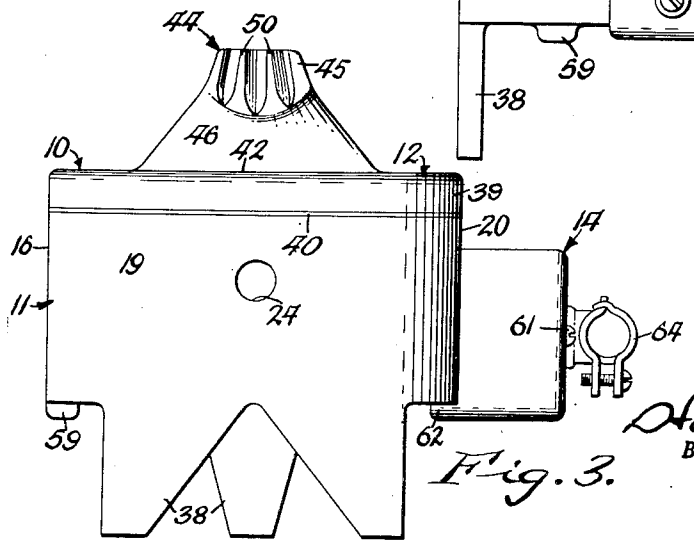


Fig. 3.

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Fig. 4.

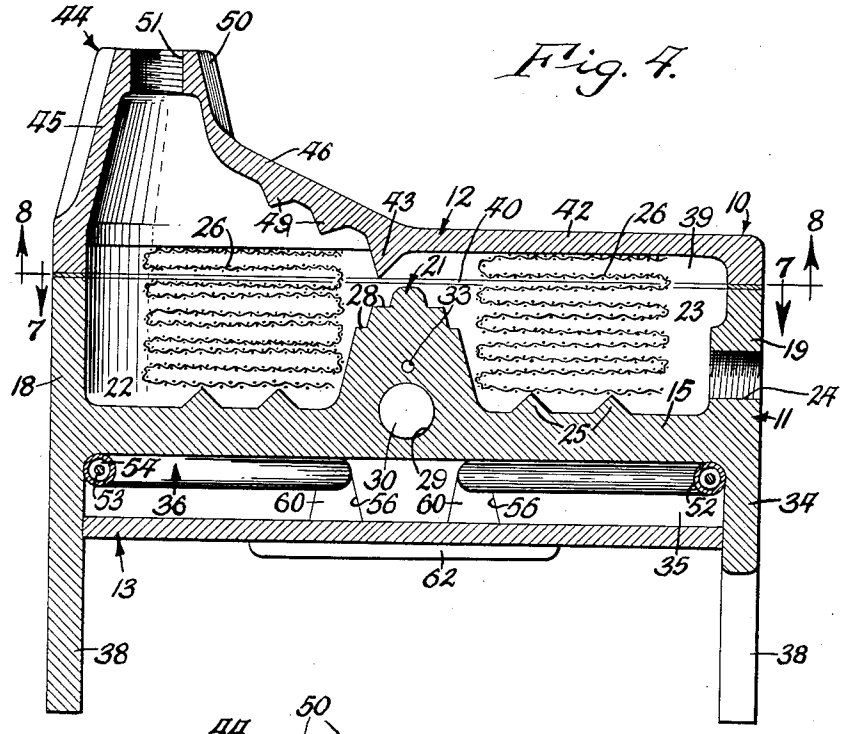
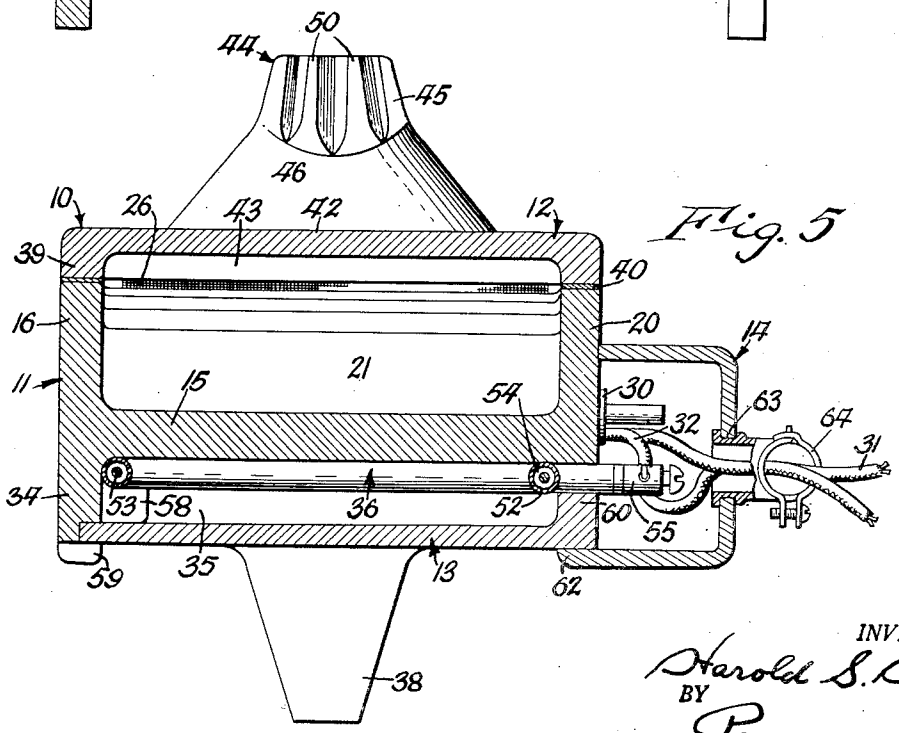


Fig. 5



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Filed Oct. 12, 1949 3 Sheets-Sheet 3

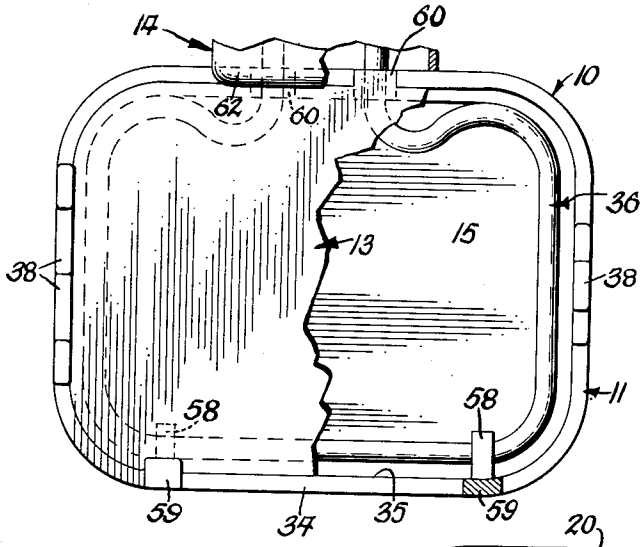


Fig. 6.

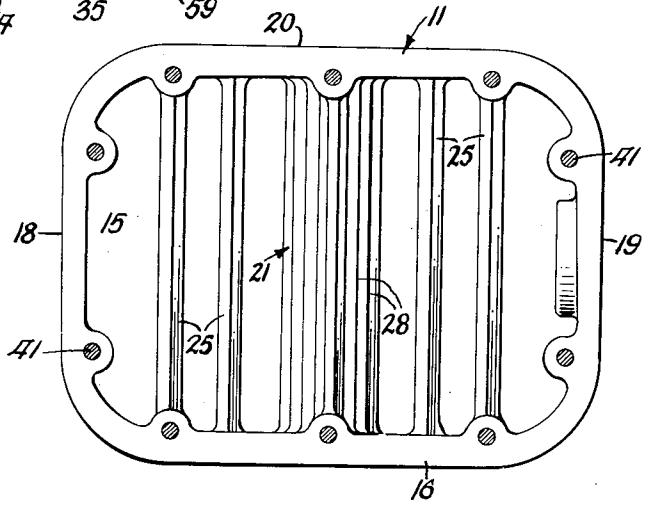


Fig. 7.

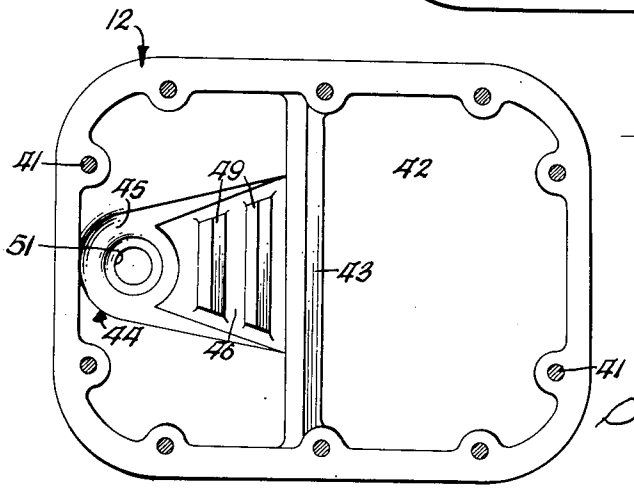


Fig 8

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Patented Apr. 15, 1952

2,592,568

UNITED STATES PATENT OFFICE

2,592,568

METHOD AND APPARATUS FOR PRETREATING LIQUID FUEL

Harold S. Hill, Lockport, N. Y.

Application October 12, 1949, Serial No. 120,968

19 Claims. (Cl. 219—39)

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This invention relates to a method and apparatus for pretreating liquid fuels, such as liquid fuels derived from petroleum, shale oil and coal and used in oil burning furnaces, gasoline engines, diesel engines and the like.

This application is a continuation-in-part of my copending application for Electric Heater, Serial No. 35,362, filed June 26, 1948, now Patent No. 2,511,848.

One of the principal objects of the present invention is to provide such a method and apparatus which during off periods of demand will segregate the lighter fractions of the stagnant body of oil retained in the heater and render these lighter fractions available for immediate withdrawal when the oil furnace, gasoline engine or the like again goes into operation. By this means the lighter and more volatile fractions of the fuel are supplied to the apparatus served each time it is started and optimum conditions are established both for instantaneous starting and also for establishing proper operating conditions for the continued burning of the liquid fuel.

Another object is to provide such a method and apparatus which during continued on periods of the apparatus being served will operate to preheat the liquid fuel to a lower temperature than that which obtains during the off periods of demand thereby to preheat the liquid fuel for improved operation of the apparatus being served without, however, separating the lighter fractions. Such lower preheat temperature during continuation of an on period of operation is desirable as the combustion of the fuel in the equipment using the fuel supplies a large part of the heat necessary for efficient operation so that less preheating is required.

Another object is to provide a preheater which is so chambered and baffled as to insure rapid heating of the liquid fuel both during on and off periods of demand and as to insure the rapid segregation of the lighter fractions during the off periods.

Another object is to provide such a preheater the wall thicknesses of certain parts of which are selected to avoid scorching of the liquid fuel with resultant flaking off of solid products of the liquid fuel and which are apt to disrupt the operation of the apparatus served.

Another object of the invention is to provide such a preheater the wall thicknesses of certain parts of which are selected to slow down the application of heat when called for and to retain heat in the walls thereby to level off the on and off periods of the preheater and to maintain more uniform liquid fuel preheating conditions.

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Another object is to provide such a preheater the wall thicknesses of certain parts of which are selected to rapidly dissipate the heat in the liquid fuel contained in the preheater thereby to condense any vaporized lighter fractions and in effect to retain them in the liquid phase while being segregated.

Another object is to provide such a preheater which can readily be equipped with an electric heating element of any desired wattage without alteration of the design of the preheater.

Another object is to provide such a preheater which will automatically adapt itself to both operating and storage conditions, the heat dissipation being such as to insure segregation of the lighter fractions of the liquid fuel for starting and the heat input being such as to provide the proper temperature rise in the liquid fuel during operation of the apparatus being served.

Another object is to provide such a preheater which can be used to vaporize the liquid fuel if desired.

Another object is to provide a thermostat control which is not subject to hunting or unnecessarily rapid action, the sensitive parts of the thermostatic control being located in the thicker walls of the preheater for this purpose.

Another object is to provide turbulence in the liquid fuel passing through the preheater to provide improved heat transfer and to insure uniformity in heating all of the liquid fuel passing therethrough to the same temperature.

Another object is to provide such a preheater which is made of a minimum number of simple sections which can be readily assembled and when assembled provide the above characteristics without danger of leakage and in which all of the electrical parts are readily available for inspection or repair without opening up the liquid fuel chamber of the preheater.

Another object is to provide a preheater having its body apertured to receive testing gages used in setting up and checking the operating conditions of the preheater.

Another object is to provide such a preheater containing a body of screening material which not only serves to retain heat and to break up and filter or screen the liquid fuel but also acts as a catalyst in segregating the lighter, more volatile fractions.

Another object is to provide such a preheater which is economical in consumption of electrical energy when electrically heated.

Another object is to provide such a preheater which is simple and inexpensive in construction and which will stand up under conditions of

severe and constant use without getting out of order or requiring repairs.

Other objects and advantages will appear from the following description and drawings in which:

Fig. 1 is a top plan view of a preheater for liquid fuel embodying the present invention.

Fig. 2 is a side elevational view, viewed from the top of Fig. 1.

Fig. 3 is an end elevational view, viewed from the right hand side of Fig. 1.

Figs. 4 and 5 are vertical sections taken on the correspondingly numbered lines on Fig. 1.

Fig. 6 is a bottom plan view with parts broken away.

Fig. 7 is a horizontal section taken on line 7—7, Fig. 4, looking downwardly, and with the screen or filter removed.

Fig. 8 is a section taken on the same line as Fig. 7 looking upwardly.

The invention is shown as comprising a casing, indicated at 10, and through which the liquid fuel to be preheated flows and which is shown as comprising four major sections, namely, a body section indicated generally at 11, a top section indicated generally at 12, a bottom plate indicated generally at 13 and a side cover section indicated generally at 14 which latter serves to protect the thermostat and heating element terminals and wiring as well as to provide an extension or shelf in securing the bottom plate 13 in position.

The body section 11 is shown as being of generally rectangular form in plan, with rounding corners, and as having a comparatively thick metal bottom 15 and relatively thick integral walls rising from this bottom and being of somewhat lesser thickness than the bottom 15, these side walls comprising a front wall 16, end walls 18 and 19 and a rear wall 20. This body is formed at its center with a relatively thick integral dam or weir 21 which extends between the front and rear walls 16 and 20 and divides the interior of the body into two chambers 22 and 23.

The compartment 23 is used as a tempering chamber in which the incoming oil is initially heated and for this purpose the end wall 19 is provided centrally with an oil inlet opening 24 adapted to receive an oil supply pipe (not shown) this inlet opening 24 being arranged close to the bottom of the chamber 23. Both compartments 22 and 23 also act as distillation chambers in which the temperature of the oil is raised above its initial flash point or lowest temperature at which light ends separate, and preferably below the fire point or lowest temperature at which heated oil gives off vapor that supports continuous combustion, this fire point being usually 10 to 15° F. higher than the initial flash point. The purpose of so heating the oil above its initial flash point is for the purpose of segregating the lighter and more volatile ends or fractions. In each chamber 22 and 23 the thick bottom wall 15 is provided with a series of integral transverse ridges 25 which serve to accelerate heat transfer to the liquid fuel and also to support a filter or screening body 26, one of such bodies being arranged in each chamber 22 and 23.

The dam 21 is also preferably provided on opposite sides of its summit with a plurality of ridges 28 which tend to provide turbulence in the oil flowing thereover. The summit of the dam 21 is preferably arranged in line with and slightly below the top rim of the body 11. This dam is also provided with a relatively large bore 29 which is open through the rear wall 20 of the casing and which is closed or blind at its front end. This bore 29 receives the sensitive end of a cylindrical thermostat 30, the terminals of which are exposed at the rear wall of the casing and are adapted to connect with wires 31 and 32. This dam is also preferably provided with a blind bore 33 which is similar to the bore 29 except that it is smaller. This bore is adapted to receive a thermometer (not shown) by means of which the operator adjusting or checking the operation of the heater can determine the actual temperature of the metal forming the dam 21. It will be seen that this dam 21 is in effect a control dam, containing the opening 29 for the thermostat 30 and which controls the temperature of this dam in the center of the body of liquid so as to insure the required degree of heat transfer from metal to liquid and so as not to have any excessively hot spots which will scorch the fuel and form carbon. This control dam 21 also has the opening 33 to receive a temperature gage to insure setting of the thermostat 30 to maintain this proper temperature of the control dam.

The underside of the body is provided with a depending skirt 34 which extends around all four sides thereof and forms a downward continuation of the side walls of the heater to form a chamber 35 for the heating element 36, as hereinafter described. The body is also supported on three integral legs 38 which form downward continuations of the skirt 34 below the end walls 18 and 19 of the heater.

The cover 12 is generally of convex form having a depending rim 39 which seats upon a gasket 40 which in turn is seated on the top face of the side walls of the body 11. The cover is preferably firmly secured to the body around its perimeter by a series of screws 41 which extend through the cover into threaded holes provided in the side walls of the body 11.

Above the chamber 23 the bottom face of the cover is comparatively flat as indicated at 42, this flat extending beyond the summit of the dam 21 and terminating in a relatively large depending ridge or bead 43 which extends transversely the full width of the casing and extends to a point approximately level with or slightly above the summit of the dam 21. Beyond this ridge or bead 43 the cover is formed to provide an integral dome 44 into which the light and more volatile ends or fractions rise and collect. This dome can be of any suitable form but is shown as having a frusto-conical portion 45 arranged adjacent the end of the heater and an inclined wall portion 46 rising gradually from a point adjacent the transverse ridge or bead 43 toward the center of the frusto-conical portion 45. The underside of the gradually rising wall portion 46 of the dome 44 is preferably provided on its underside with a pair of transverse ridges 49 which serve not only to impede the upward movement of the light ends of the oil but also to accelerate the transfer of heat from these light ends to the cover. To further accelerate the dissipation of heat from these light ends the dome is preferably provided with an external extended fin surface, these fins being shown as vertical fins 50 projecting outwardly from the frusto-conical portion 45 of the dome. The summit of this frusto-conical portion 45 of the dome is provided with a vertical outlet opening 51 adapted to receive a pipe (not shown) leading to the oil burner or other apparatus being served.

Heat is shown as supplied from the heating

element indicated generally at 36 and arranged in the chamber 35 in contact with or close proximity to the underside of the bottom 15 of the casing. This heating element can be of any type and heated by steam, exhaust gas or any other medium, and is shown as being in the form of a metal tube 52 housing an electrical resistance wire 53 separated therefrom by insulating beads 54 and the ends of the resistance heating wire 53 being connected with suitable binding posts 55. The heating element is shown as being of generally U-shaped form so as to conform to and be in closely spaced relation with the skirt 34 of the heater, and at the rear of the heater the ends of this resistance heating element 36 are shown as being brought together and extending through a pair of notches 56 formed in the rear part of the skirt 34 and within the area enclosed by the cover section 13. Below the front wall 16 the heating element 36 is preferably supported by a pair of lugs 58 which project rearwardly from the skirt 34.

In addition, a second pair of supporting lugs 59 are formed integrally with the portion of the skirt 34 below the front wall 16 of the casing. These lugs are disposed below the lugs 58 and project rearwardly to support the front edge of the bottom plate 13. At its rear this plate is provided with a pair of upwardly projecting bosses 60 each of which projects into a corresponding one of the notches 56 and engages the corresponding end of the heating element 36 projecting through this notch so as to hold the rear part of the heating element firmly in position.

The rear end of the bottom plate 13 is supported by the side cover section 14 of the heater. This side cover section is in the form of an open sided box fitted against the rear wall 20 of the body in position to enclose the end of the thermostat 30 and the binding posts 55 at opposite ends of the heating element 36 and is shown as being secured in position by a pair of horizontal screws 61 which extend through the back of the cover into threaded holes provided in the rear wall 20 of the body. To support the rear edge of the bottom plate 13, the bottom wall of this cover 14 is formed to provide a forwardly projecting lip 62 which extends under the bottom plate 13 as best shown in Fig. 5 so as to support the same, the front edge of this cover plate being supported by the lugs 59 as previously described.

The wire 32 from the thermostat 30 connects with one of the binding posts 55 of the heating element 36, the other binding post being connected with a wire 31. The wires 32 and 31 form the line wires and extend outwardly through an opening 63 in the rear wall of the cover section 14 and through a conventional fitting 64 which is secured to the rear wall of the cover section 14 in any suitable manner. It will be understood that for safety a conventional fusible link (not shown) can be included in the electrical circuit housed within the cover section 14.

In the operation of the invention for pretreating, say, petroleum fuel oil for an oil burning furnace, the furnace is automatically cut into and out of operation in response to the demand for heat. During off periods no fuel is called for and the body of liquid fuel in the casing 10 becomes a stagnant or quiescent body. An important feature of the invention resides in the setting of the thermostat 30 a few degrees above the initial flash point of the liquid fuel, and preferably, though not necessarily below the fire point or lowest temperature at which heated oil

gives off vapor that supports continuous combustion, this fire point being usually 10 to 15° F. higher than the initial flash point. Thus, if the initial flash point of the liquid fuel being used is, say, 148° F., and the fire point is, say, 160° F., the thermostat 30 would be set to cut into operation at 150° F., and to cut out of operation at 153° F. This setting of the thermostat is readily accomplished by the operator who sets the apparatus, the operator knowing the flash point and fire point from data supplied to him or determining the flash point of the fuel being used for himself and then inserting a thermometer (not shown) in the hole 33 provided in the control dam 21 for this purpose. With such thermometer inserted in the control dam 21, the operator can readily set the thermostat 30 to cut into and out of operation at the temperatures indicated. Access to both the open end of the hole 33 and to the thermostat 30 can readily be obtained by removing the two screws 61, which secure the cover 14 for the thermostat.

With the thermostat so set it would call for heat during on periods of the furnace and accordingly at the start of the off period of the furnace, the heating element 36 is energized and heat is being applied by this element to the relatively thick bottom wall 15 of the casing 10. This energization of the electric heating element continues until the temperature of the control dam 21 builds up to the assumed 153° F., the quiescent body of fuel in the bottom of the chambers 22 and 23 also being heated to approximately this temperature. It will particularly be noted that this heat is applied at the bottom of the quiescent body of liquid fuel by the thick bottom wall 15 and, through conduction through the metal, at the sides of the body of liquid fuel from the thick control dam 21 and relatively thick side walls of the casing 10.

As each particle of the liquid fuel is heated above its flash point, the lighter or more volatile fraction thereof vaporizes and rises in the quiescent body of liquid fuel. On encountering cooler fuel, this vaporized fraction, of course, recondenses, but since heat is applied from the sides and bottom of the quiescent body of fuel, the net effect of the vaporization and recondensing of the more volatile fraction or light ends of the liquid fuel is a migration of the light ends to the top of the body of liquid fuel. Since the cover, above the chamber 22, is inclined, these lighter ends migrate up into the conical part 45 of the dome 44. It will be noted that this conical part of the dome is relatively thin walled and also is provided with the fins 50 so as to rapidly dissipate heat to the atmosphere. Accordingly after entering the dome 44 and contacting its walls the light ends are cooled below their flash point and hence condense and remain as a segregated body of light ends within the conical dome 44.

This migration of the lighter ends from the chamber 23 is impeded by the rib or baffle 43 under which any article of fuel oil must pass in close proximity to the heated dam 21 before it can escape to the dome 44. This provides independent distillation action in the two chambers 22 and 23, only the substantially completely distilled lighter ends being permitted to escape from the chamber 23 into the chamber 22.

The upward migration of the lighter ends is also impeded by the screen bodies 26 with which each chamber 22 and 23 is packed. This screening serves not only to distribute the heat throughout the body of liquid fuel in each cham-

ber 22 and 23 and also to act as a catalyst, but also serves to prevent on effective convection current from being set up in either chamber 22 or 23. Without these screen bodies there would be a tendency for the cooled fuel at the top of each chamber to flow down the center of the liquid fuel therein with the liquid fuel at the sides rising to replace this cooled liquid fuel. Such a convection movement can be of sufficient force to prevent the segregation of the light ends in the dome 44 and is effectively inhibited by the presence of the screen bodies 26.

Accordingly during off periods of demand mild distillation action takes place which effects a segregation of the light ends or more volatile fraction in the dome 44. Therefore when the furnace goes into operation the fuel initially supplied is not only heated to a relatively high temperature but also is more highly volatile than the fuel supplied to the preheater. Accordingly ignition of this initially supplied fuel at the start of each on period is materially expedited and proper combustion of the fuel for a substantial time on each start is assured. After this starting period the combustion of the less volatile fuel supplied at a lower temperature presents no problem, proper economy in fact demanding that the burner be set to operate with the fuel of average volatility and at a lower preheated temperature. Accordingly the capacity of the heating element 36 is deliberately selected so as to heat the liquid fuel flowing through the preheater on continued operation of the fuel burner to only a fraction of the setting of the thermostat 30. This is for the reason that during a continued on period the combustion of the fuel in the apparatus supplies part of the heat for efficient operation so that preheating to a lower temperature is required. It will also be noted, that the transition from the high initial temperature of the fuel oil in each on period to the relatively low running temperature is gradual, this being due to the heat stored in the relatively thick bottom wall 15, relatively thick side walls and also the relatively thick control dam 21 of the casing section 11.

As long as the on period lasts preheated liquid fuel is supplied by the preheater and when the demand of the burner is satisfied, the flow of liquid fuel through the preheater is stopped. Accordingly, the now quiescent body of liquid fuel in the preheater is again heated to a few degrees above its flash point to again segregate the light ends in the dome 44 for the start of another on period.

It will also particularly be noted that all parts of the heater, particularly the electrical components, are readily accessible. Thus by removing the screws 61 which attach the rear cover section 14, this section can be removed to expose the terminals of the thermostat 30 and heating element 36 as well as to expose the end of the blind bore 33 for insertion of a thermometer to check operation. This removal of the rear cover section 14 also removes the lip 62 from under the bottom plate 13 which then drops and can be removed. Dropping the bottom plate 13 removes its upstanding lugs 60 from supporting engagement with the terminal ends of the heating element 36 which can therefore be removed downwardly, the front part thereof being merely supported by the lugs 58.

From the foregoing it will be seen that the present invention provides a very simple and efficient method and apparatus for pretreating liquid fuels which effectively segregates, during off periods, the lighter and more volatile fractions of the liquid fuel and renders them available at high temperature for each start of the fuel burner or other apparatus being served. It will also be seen that the method and apparatus is effective, to the degree desired for efficient operation, during continued running conditions.

I claim:

1. A preheater for liquid fuels for apparatus having on and off periods of operation, comprising a casing having an inlet for said liquid fuel, a heater arranged to apply heat at a temperature above the initial flash point of said liquid fuel to the lower part only of the body of fuel within said casing, and a thin walled, small dome rising from a part only of the top of said casing and subject to external cooling and into which the more volatile fraction distilled by said heater rises and segregates, the outlet for said casing being from said dome whereby said more volatile fraction is supplied by the preheater at the start of each on period of the apparatus being served.

2. A preheater for liquid fuels for apparatus having on and off periods of operation, comprising a casing having an inlet for said liquid fuel and subject to external cooling, a heater arranged to apply heat at a temperature above the initial flash point of said liquid fuel to the lower part only of said casing, a dome maintained by said external cooling at a temperature below said initial flash point and into which the more volatile fraction distilled by said heater rises and segregates, the outlet for said casing being from said dome whereby said more volatile fraction is supplied by the preheater at the start of each on period of the apparatus being served, and a body of loose material in said casing and inhibiting convection currents of the liquid fuel therein.

3. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a metal casing having relatively thick bottom and side walls and a relatively thin top wall subject to external cooling, said casing having an inlet for said fuel, a heater arranged to apply heat to said bottom wall at a temperature above the initial flash point of sai dliquid fuel, and a relatively thin walled metal dome rising from a part of said top wall and maintained by said external cooling at a temperature below said initial flash point and into which the more volatile fraction distilled by said heater rises and segregates, the outlet for the casing being from said dome whereby said more volatile fraction is supplied by the preheater at the start of each on period of the apparatus being served.

4. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a metal casing having relatively thick bottom and side walls and a relatively thin top wall subject to external cooling, said casing having an inlet for said fuel, a heater arranged to apply heat to said bottom wall at a temperature above the initial flash point of said liquid fuel, and a relatively thin walled externally fin surfaced metal dome rising from a part of said top wall and maintained by said external cooling at a temperature below said initial flash point and into which the more volatile fraction distilled by said heater rises and segregates, the outlet for the casing being from said dome whereby said more volatile fraction is supplied by the preheater at the start of each on period of the apparatus being served.

5. A preheater for liquid fuel for apparatus

having on and off periods of operation, comprising a metal casing having relatively thick bottom and side walls and a relatively thin top wall subject to external cooling, a plurality of ridges projecting downwardly into said casing from said top wall, a plurality of ridges projecting upwardly into said casing from said bottom wall, said casing having an inlet for said fuel, a heater arranged to apply heat to said bottom wall at a temperature above the initial flash point of said liquid fuel, and a relatively thin walled externally fin surfaced metal dome rising from a part of said top wall and maintained by said external cooling at a temperature below said initial flash point and into which the more volatile fraction distilled by said heater rises and segregates, the outlet for the casing being from said dome whereby said more volatile fraction is supplied by the preheater at the start of each on period of the apparatus being served.

6. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a casing having at one end an inlet for said liquid fuel, a transverse control dam across the interior of said casing and dividing said casing into an inlet chamber at said one end of said casing and an outlet chamber at the other end thereof, said control dam being composed of a relatively large mass of metal and having an opening adapted to receive the sensitive parts of a thermostat arranged in one of said openings, a heater controlled by said thermostat and arranged to apply heat at a temperature above the initial flash point of said liquid fuel to the lower part of the body of fuel within said casing, and a dome above said outlet chamber and rising from the corresponding end of the top of said casing and into which the light ends distilled by said heater rise and segregate, the outlet for said casing being from said dome whereby said light ends are supplied by the preheater at the start of each on period of the apparatus being served.

7. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a casing having at one end an inlet for said liquid fuel, a transverse control dam across the interior of said casing, and dividing said casing into an inlet chamber at said one end of said casing and an outlet chamber at the other end thereof, said control dam being composed of a relatively large mass of metal and having openings adapted to receive the sensitive parts of a thermostat and a thermometer, a thermostat arranged in one of said openings, a heater controlled by said thermostat and arranged to apply heat at a temperature above the initial flash point of said liquid fuel to the lower part of the body of fuel within said casing, a dome above said outlet chamber and rising from the corresponding end of the top of said casing and into which the light ends distilled by said heater rise and segregate, the outlet for said casing being from said dome whereby said light ends are supplied by the preheater at the start of each on period of the apparatus being served and a body of loose material in each of said chambers and inhibiting convection currents of the liquid fuel therein.

8. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a casing having at one end an inlet for said liquid fuel, a transverse control dam across the interior of said casing, and dividing said casing into an inlet chamber at said one end of said casing and an outlet chamber at the other end

thereof, a heater arranged to apply heat at a temperature above the initial flash point of said liquid fuel to the lower part of the body of fuel within said casing, a dome above said outlet chamber and rising from the corresponding end of the top of said casing and into which the light ends distilled by said heater rise and segregate, the outlet for said casing being from said dome whereby said light ends are supplied by the preheater at the start of each on period of the apparatus being served, and a body of loose, highly heat conductive material in each of said chambers and inhibiting convection currents of the liquid fuel therein.

9. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a metal casing having at one end an inlet for said liquid fuel and having relatively thick bottom and side walls and a relatively thin top wall subject to external cooling, a transverse, relatively thick metal control dam across the interior of said casing and dividing said casing into an inlet chamber at said one end of said casing and an outlet chamber at its other end thereof said control dam being composed of a relatively large mass of metal and having an opening adapted to receive the sensitive parts of a thermostat arranged in one of said openings, a heater controlled by said thermostat and arranged to apply heat to said bottom wall at a temperature above the initial flash point of said liquid fuel, and a relatively thin walled metal dome above said outlet chamber and rising from the corresponding end of said top wall and maintained by said external cooling at a temperature below said initial flash point and into which the light ends distilled by said heater rise and segregate, the outlet for said casing being from said dome whereby said light ends are supplied by the preheater at the start of each on period of the apparatus being served.

10. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a metal casing having at one end an inlet for said liquid fuel and having relatively thick bottom and side walls and a relatively thin top wall subject to external cooling, a transverse, relatively thick metal dam across the interior of said casing and dividing said casing into an inlet chamber at said one end of said casing and an outlet chamber at the other end thereof, a heater arranged to apply heat to said bottom wall at a temperature above the initial flash point of said liquid fuel, and a relatively thin externally fin surfaced walled metal dome above said outlet chamber and rising from the corresponding end of said top wall and maintained by said external cooling at a temperature below said initial flash point and into which the light ends distilled by said heater rise and segregate, the outlet for said casing being from said dome whereby said light ends are supplied by the preheater at the start of each on period of the apparatus being served.

11. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a metal casing having at one end an inlet for said liquid fuel and having relatively thick bottom and side walls and a relatively thin top wall subject to external cooling, a transverse, relatively thick metal dam across the interior of said casing and dividing said casing into an inlet chamber at said one end of said casing and an outlet chamber at the other end thereof, a heater arranged to apply heat to said bottom wall at a

temperature above the initial flash point of said liquid fuel, a relatively thin externally fin surfaced walled metal dome above said outlet chamber and rising from the corresponding end of said top wall and maintained by said external cooling at a temperature below said initial flash point and into which the light ends distilled by said heater rise and segregate, the outlet for said casing being from said dome whereby said light ends are supplied by the preheater at the start of each on period of the apparatus being served, and a plurality of transverse ridges projecting downwardly into said casing from said top wall above said outlet chamber and interposed between the summits of said dome and dam to impede the movement of said liquid fuel along said top wall into said dome.

12. A preheater for liquid fuel for apparatus having on and off periods of operation, comprising a metal casing having at one end an inlet for said liquid fuel and having relatively thick bottom and side walls and a relatively thin top wall subject to external cooling, a plurality of ridges projecting upwardly into said casing from said bottom wall, a transverse, relatively thick metal dam across the interior of said casing and dividing said casing into an inlet chamber at said one end of said casing and an outlet chamber at the other end thereof, a heater arranged to apply heat to said bottom wall at a temperature above the initial flash point of said liquid fuel, a relatively thin externally fin-surfaced walled metal dome above said outlet chamber and rising from the corresponding end of said top wall and maintained by said external cooling at a temperature below said initial flash point and into which the light ends distilled by said heater rise and segregate, the outlet for said casing being from said dome whereby said light ends are supplied by the preheater at the start of each on period of the apparatus being served and a plurality of transverse ridges projecting downwardly into said casing from said top wall above said outlet chamber and interposed between the summits of said dome and dam to impede the movement of said liquid fuel along said top wall into said dome.

13. A preheater comprising an enclosed casing having an inlet and an outlet and having a marginal depending skirt forming a heating element chamber, an electrical resistance heating element within said chamber and having its terminal ends projecting outwardly through a pair of upwardly extending notches provided in one side of said depending skirt, a bottom plate for said heating element chamber and projecting under the notched side of said depending skirt, a lug projecting horizontally inwardly from the side of said depending skirt opposite said notches and supporting the corresponding side of said bottom plate, a housing section arranged to enclose the terminal ends of said electrical resistance heating element, means removably securing said housing section to the exterior of the corresponding side wall of said casing, and a lip projecting horizontally from said housing section under the corresponding side of said bottom plate to support the same.

14. A preheater comprising an enclosed casing having an inlet and an outlet and having a marginal depending skirt forming a heating element chamber, an electrical resistance heating element within said chamber and having its terminal ends projecting outwardly through a pair of upwardly extending notches provided in one side of said depending skirt, a bottom plate for said heating element chamber and projecting under the notched side of said depending skirt, a pair of upwardly projecting lugs on said bottom plate and arranged to project upwardly into said notches to support said terminal ends of said electrical resistance heating element, a lug projecting horizontally inwardly from the side of said depending skirt opposite said notches and supporting the corresponding side of said bottom plate, a housing section arranged to enclose the terminal ends of said electrical resistance heating element, means removably securing said housing section to the exterior of the corresponding side wall of said casing, and a lip projecting horizontally from said housing section under the corresponding side of said bottom plate to support the same.

15. A preheater comprising an enclosed casing having an inlet and an outlet and having a marginal depending skirt forming a heating element chamber, an electrical resistance heating element within said chamber and having its terminal ends projecting outwardly through a pair of upwardly extending notches provided in one side of said depending skirt, a lug projecting horizontally inwardly from the side of said depending skirt opposite said notches and arranged to support the corresponding side of said electrical resistance heating element, a bottom plate for said heating element chamber and projecting under the notched side of said depending skirt, a pair of upwardly projecting lugs on said bottom plate and arranged to project upwardly into said notches to support said terminal ends of said electrical resistance heating element, a lug projecting horizontally inwardly from the side of said depending skirt opposite said notches and supporting the corresponding side of said bottom plate, a housing section arranged to enclose the terminal ends of said electrical resistance heating element, means removably securing said housing section to the exterior of the corresponding side wall of said casing, and a lip projecting horizontally from said housing section under the corresponding side of said bottom plate to support the same.

16. An electric heater for fuel oil or the like, comprising a horizontally elongated casing having a bottom wall, an enclosing side wall and a top wall, an oil inlet pipe extending through said casing and discharging oil into one end of said casing near the bottom thereof, a transverse central partition in said casing and having its opposite vertical edges secured to opposite longitudinal parts of the side wall of said casing and having opposite horizontal bottom edges secured to the bottom wall of said casing to provide a central dam across the interior of said casing and rising a substantial distance above said inlet, an electrical heating element arranged on the side of said dam remote from said oil and in heat exchange relation therewith, and an oil outlet pipe extending through said casing and having its outlet arranged adjacent said top wall at the end of said casing opposite said oil inlet pipe.

17. An electric heater for fuel oil or the like, comprising a horizontally elongated casing having a bottom wall, an enclosing side wall and a top wall, an oil inlet pipe extending through said casing and discharging oil into one end of said casing near the bottom thereof, a transverse central partition in said casing and having its opposite vertical edges secured to opposite longitudinal parts of the side wall of said casing and

having opposite horizontal bottom edges secured to the bottom wall of said casing to provide a central dam across the interior of said casing and rising a substantial distance above said inlet, an electrical heating element arranged on the side of said dam remote from said oil and in heat exchange relation therewith, said top wall of said casing being formed at the end opposite said oil inlet pipe to provide a dome rising from the top wall of said casing at the end thereof opposite said oil inlet pipe, and an oil outlet pipe extending through said casing and having its inlet arranged within the space provided by said dome.

18. The method of pretreating liquid fuels having volatile fractions and supplied to combustion apparatus at intervals determined by the demand on such apparatus, which comprises confining a body of said fuel to provide a stagnant body thereof during off periods of demand, dividing said body into a plurality of connected units to provide a sponge-like body in which convection currents are inhibited, heating the lower part only of said body to a temperature above the initial flash point of said fuel during such off period of demand to cause the more volatile fraction thereof to migrate to the top of said body, cooling the top of said body during said off period of demand to condense and segregate said more volatile fraction in the top of said body, supplying the fuel to said apparatus from said top of said body whereby said segregated more volatile fraction is supplied to said apparatus at the beginning of each on period of demand, and supplying fuel to said body at a place remote from the place where said more volatile fraction is so supplied to said apparatus.

19. The method of pretreating liquid fuels having volatile fractions and supplied to combustion apparatus at intervals determined by the demand on such apparatus, which comprises confining

a body of said fuel to provide a stagnant body thereof during off periods of demand, dividing said body into a plurality of connected units to provide a sponge-like body in which convection currents are inhibited, heating the lower part only of said body to a temperature above the initial flash point of said fuel and below the fire point thereof during such off period of demand to cause the more volatile fraction thereof to migrate to the top of said body, cooling the top of said body during said off period of demand to condense and segregate said more volatile fraction in the top of said body, supplying the fuel to said apparatus from said top of said body whereby said segregated more volatile fraction is supplied to said apparatus at the beginning of each on period of demand, and supplying fuel to said body at a place remote from the place where said more volatile fraction is so supplied to said apparatus.

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