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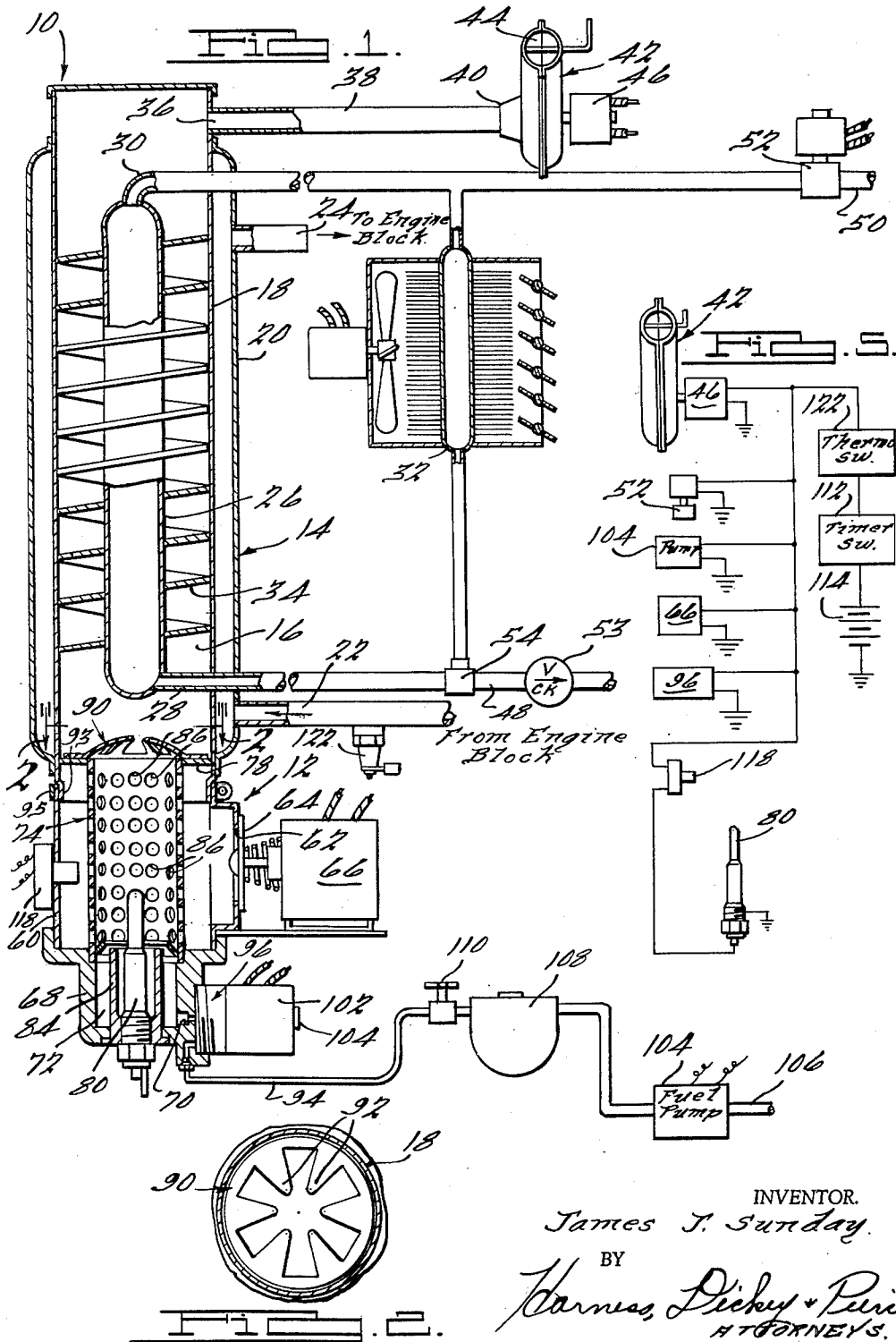
J. J. SUNDAY

3,072,176

HEATER

Filed Oct. 3, 1958

2 Sheets-Sheet 1



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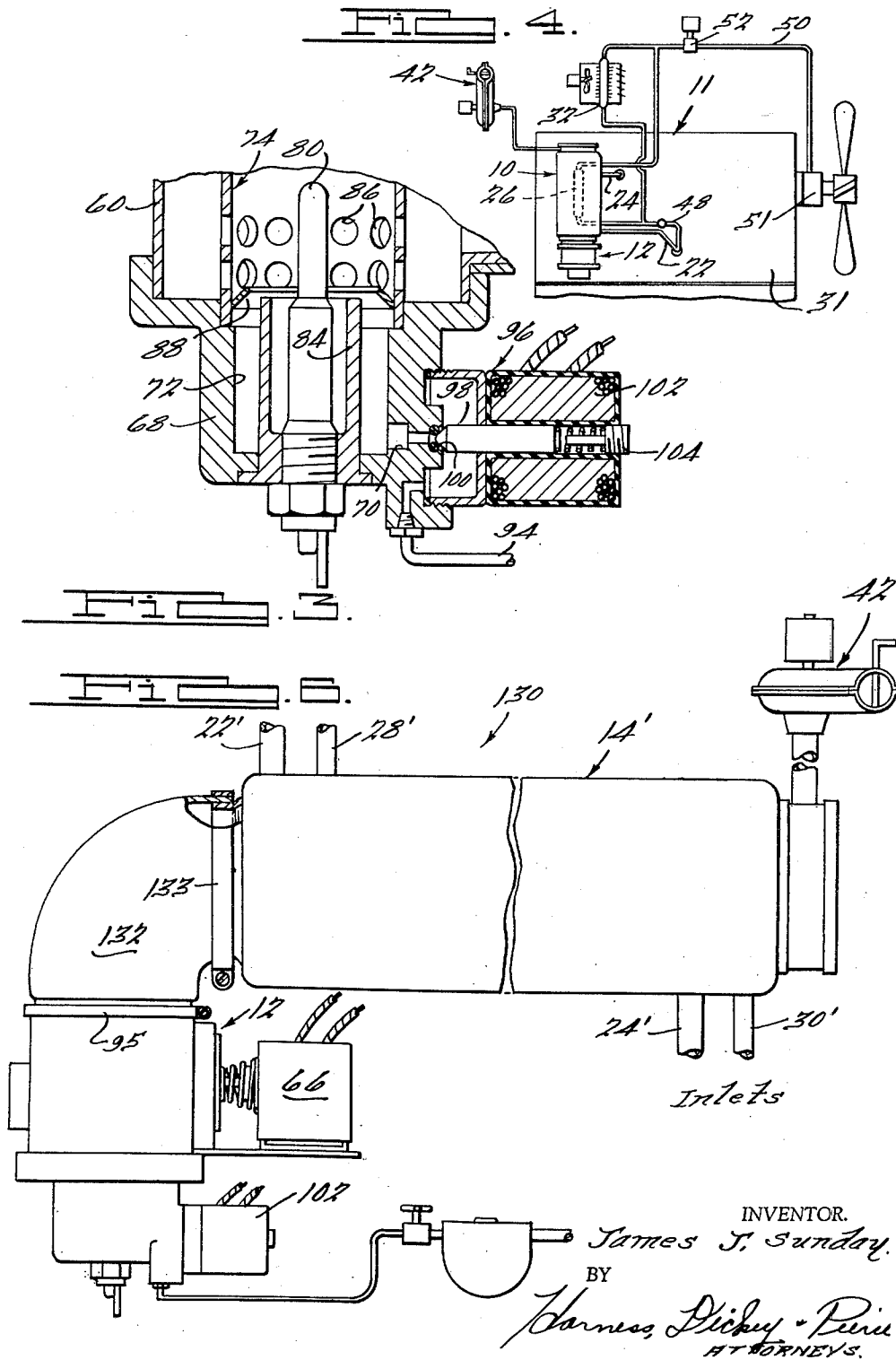
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HEATER

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2 Sheets-Sheet 2



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3,072,176
HEATER

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10 Claims. (Cl. 158—28)

This invention relates to an improved heater assembly including an improved pot type burner for burning a vaporizable fuel such as gasoline.

One important object of the present invention is to provide an improved vaporizing pot type burner including means for reducing the atmospheric pressure upon the liquid fuel being vaporized thereby to facilitate the vaporization thereof, particularly at the beginning of combustion.

Further objects of the invention are: to provide an improved relatively highly efficient pot type burner for gasoline and similar volatilizable fuels including suction forced draft means; to provide an improved heater assembly capable of efficiently burning a vaporizable fuel at a regulatable rate, the burner portion of the assembly being arranged to provide a relatively rich air-fuel vapor mixture immediately adjacent to a re-igniter element during the start-up time of the heater; to provide an improved heater assembly particularly well adapted for use as an auxiliary heater for the cooling system of an internal combustion engine, such as a vehicle engine, and in general to provide an improved heater assembly of rugged and long lasting, yet compact and relatively inexpensive construction, which is capable of burning a liquid fuel such as gasoline or kerosene efficiently and cleanly, and which is readily adaptable for a wide variety of uses.

The foregoing and other objects and advantages of the invention will become apparent in the following detailed description of a preferred embodiment thereof taken in conjunction with the drawings wherein:

FIGURE 1 is a partly schematic cross-sectional view of an auxiliary heater according to a preferred embodiment of the invention;

FIG. 2 is a horizontal sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged cross-sectional view of that portion of the heater shown in FIG. 1 enclosed within the circle 3 thereof;

FIG. 4 is a side elevational view showing the heater installed on an internal combustion engine;

FIG. 5 is a schematic circuit diagram showing the electrical connections for the control circuit of the heater; and

FIG. 6 is a side elevational view of the heater according to the invention with the combustion chamber and heat exchange portions thereof arranged in a horizontal position.

Referring now to the drawings in detail, a heater 10 according to a preferred embodiment of the present invention is shown therein as adapted for use in connection with preheating the coolant of a liquid cooled internal combustion engine 11, such as an automobile or truck engine. The heater 10 includes a burner 12, and a heat exchanger 14, which is arranged to transfer the heat generated by the burner to fluids contained in two separate circuits. As shown, the heat exchanger 14 includes a cylindrical housing 18 defining a combustion chamber 16 and surrounded by a water jacket 20, which has an inlet 22 near the bottom and an outlet 24 near its top. A closed cylindrical member 26 is disposed coaxially within the housing 18 and is provided with a bottom inlet 28 and an upper outlet 30. As illustrated, the water jacket 20 is used for heating the engine coolant in

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the engine block 31, and the inner member 26 is arranged in a separate fluid circuit such as, for example, a circuit including the vehicle space heater 32 which may be mounted for warming the passenger compartment of the vehicle in which the heater 10 is installed.

A spiral baffle 34 is fitted within the housing 18 between the housing wall and the member 26. The baffle 34 serves two principal functions. It serves as a spacer to support the inner cylindrical member 26, and also improves the efficiency of heat transfer by causing the combustion products from the burner 12 to travel in a tight spiral path through the combustion chamber 16. The exhaust port 36 is arranged at the top of the heat exchanger, and is connected by means of an exhaust duct, or conduit 38 to the inlet 40 of a blower 42, the outlet 44 of which is vented to atmosphere. The blower 42 is driven by an electric motor 46, which may be connected to the vehicle power supply through the control circuit hereinafter described.

The illustrated heat exchanger 14 is particularly advantageous for use in automotive vehicles wherein it is desired not only to warm the engine coolant in the engine block, but also to provide heat at a relatively higher temperature for warming the passenger compartment or for some other purpose. The water jacket 20 is connected to the engine block 31, the outlet 24 being connected to a relatively high point on the block, and the inlet 22 being connected to a point low on the block so that heating of the coolant in the water jacket 20 will cause convection circulation throughout substantially the entire engine block, and thereby warm the engine and the lubricant stored therein. The inner member 26 is connected to the space heater 32 for heating the passenger compartment or other enclosed space of the vehicle. During normal operation of the engine, the space heater 32 is warmed by the engine coolant, a portion of which is directed through a conduit 50 from the engine water pump 51 to the heater 32, and is returned to the block 31 through another conduit 48. This circuit is closed during operation of the auxiliary heater 10 by a solenoid actuated valve 52 in the conduit 50 in order to confine the liquid warmed in the inner member 26 to the space heater circuit and to prevent its diversion to the engine block 31. Also, a check valve 53 is provided in the other conduit 48 to insure against reverse flow.

The construction and arrangement of the heat exchanger 14 are such that in operation the liquid in the circuit of the inner member 26 is heated to a relatively high temperature, and the liquid in the water jacket 20 is heated to a relatively low temperature. Three principal factors are involved to achieve this effect. First, the capacity of the water jacket 20 is made larger than the capacity of the inner member 26 so that a greater amount of heat is required to raise the temperature of its contents to the same degree as the contents of the inner tube 26. Second, the exterior wall of the water jacket 20 is exposed to the ambient atmosphere and is cooled thereby, and also radiates heat outwardly for further cooling, whereas the inner member 26 is completely surrounded by the combustion chamber and can dissipate heat absorbed therefrom only inwardly into its liquid contents. Third, the fluid circuit in which the water jacket 20 is connected includes all of the coolant in the entire engine block 31, whereas the quantity of liquid in the circuit of the inner member 26 is relatively small.

In operation, therefore, when the heater is operated to preheat the engine before the engine is started, heat rises relatively rapidly in the circuit of the inner member 26 and liquid therein quickly attains a relatively high temperature even though the engine coolant in the main

circuit of the water jacket 20 is heated relatively slowly and may even remain well below a satisfactory temperature for passenger compartment heating purposes.

The burner 12 is of the vaporizing pot type, and in the arrangement shown has been found to be exceedingly efficient and clean-burning and free from most of the troubles encountered in previous gasoline burning pot type burners. The burner 12 comprises an outer housing 60, which is tubular in form and is provided with an air opening 62 for the admission of combustion air. The opening 62 is closable by a closure member 64 to insure prompt snuffing of the fire immediately after the heater is turned off. During operation, the closure member 64 is retracted by a solenoid actuator 66, which permits air to enter freely through the opening 62.

The lower end of the burner housing 60 is closed by a fuel receptacle 68, which may be secured to the housing 60 by any desired means such as by brazing. The central portion of the receptacle 68 is cup-shaped and constitutes a relatively small diameter vaporizing pot 72, to which fuel is supplied at a regulated rate through an inlet port 70 located near the bottom of the pot 72. A perforated cylindrical shell 74 of about the same diameter as the vaporizing pot 72 is mounted within the housing 60 immediately above the pot 72 for insuring an even distribution of combustion air into the fuel vapors rising from the vaporizing pot 72. An outwardly extending annular flange 78 is fixed to the shell 74 at the upper end thereof to close the annular space between the shell 74 and the housing 60 and thereby to exclude secondary combustion air from entering the combustion chamber 16.

An electrical resistance type igniter 80 is mounted in the bottom of the receptacle 68 and extends upwardly therefrom into the space enclosed by the shell 74. The igniter 80 is arranged to concentrate its heat in the shell space and to minimize its heating effect on the fuel in the vaporizing pot 72. In this way, the warm-up time of the igniter 80 is minimized, and the generation of excess fuel vapors is avoided during the warm-up time. The igniter 80 is shielded from the fuel by an impermeate cylindrical shield 84 which extends upwardly from the bottom of the receptacle 68 and surrounds the lower portion of the igniter 80, insulating it from the fuel in the vaporizing pot 72 and thereby minimizing the direct heat loss from the igniter 80 into the liquid fuel. This facilitates the rapid attainment of a sufficiently high temperature at the upper end of the igniter 80 for positive ignition of the fuel very quickly after the heater is turned on.

An annular, conically tapered auxiliary baffle 88 is mounted in the perforated shell 74 near the lower end thereof, and around the igniter 80 for directing fuel vapors escaping from the vaporizing pot 72 radially inwardly toward the igniter 80. This auxiliary baffle 88 insures the presence of a relatively rich fuel-air mixture at the surface of the igniter 80, even though the over-all mixture ratio is lean.

A star cut re-igniter plate 90 is fitted over the open upper end of the shell 74, and includes radially inwardly projecting fingers 92, which become heated to incandescence during the initial operation of the burner while the electrical igniter 80 is energized, so that after the burner is started and the electrical igniter 80 is de-energized, as hereinafter described, the fingers 92 insure ignition of the fuel-air combustion mixture as it is drawn upwardly from within the shell 74. The star cut re-igniter 90 is cold during periods that the burner is inactive and is heated only by the burner flame. It is not used to start the heater, but serves only to insure continued combustion once the burner has started operation.

The burner 12 may, if desired, be brazed, or otherwise integrally attached to the heat exchanger 14, but preferably in order to provide a greater degree of freedom in installation the burner 12 is adjustably attached

to the heat exchanger 14, as, for example, by the clamped arrangement shown in FIG. 1. In this arrangement, the bottom flange 93 of the heat exchanger housing 18 is dimensioned to fit snugly within the burner housing 60. A clamp 95 encircles the housing 60 at the upper end thereof, and is tightened to secure the burner to the heat exchanger.

This attachment arrangement permits ready rotation of the burner 12 relative to the heat exchanger 14 at the time of installation, so that the projecting elements of the heater may be oriented to avoid interfering with other engine accessories and to facilitate a neat and orderly arrangement of the fluid conduits which are connected between the heater and the engine.

Fuel is delivered to the burner through the inlet port 70, which is connected to the fuel inlet conduit 94 through an adjustable, solenoid actuated valve 96. The valve 96 includes a magnetic needle 98, which is spring biased toward and seats against an O-ring 100. The rate of fuel feed is controlled by a fuel adjustment screw 104, which is arranged to limit the opening travel of the needle 98, and thus cause the needle 98 to act as a restrictor for limiting the flow of fuel into the burner.

The heater as illustrated is arranged to operate on the regular fuel of the vehicle in which it is mounted. In many modern vehicles the fuel tank is located lower than the inlet port 70 of the burner, and it is necessary to pump fuel from the tank (not shown) to the burner. Some vehicles are equipped with electrically actuatable pumps, which are normally continuously operated while the engine is in operation for pumping fuel from the tank to the carburetor. In vehicles of this type, provision is made for energizing the regular fuel pump whenever the heater is turned on. Other vehicles, however, have mechanically driven fuel pumps, which are cam actuated from the engine and operate only while the engine is operating. In vehicles of this latter type, a separate, electrically operated fuel pump 104 is provided with the heater of the present invention, and such an arrangement is shown in the drawings.

A fuel pump 104 of the electrically operated type is shown connected between the main fuel line 106 leading to the fuel tank of the vehicle and a float valve 108, and operates continuously during operation of the burner to deliver liquid fuel under pressure to the float valve. The float valve 108 serves as a pressure reducing device and delivers fuel into the inlet line 94, and thence to the heater under gravity flow, and also limits the level to which liquid fuel can rise in the vaporizing pot 72. A manual cut-off valve 110 may also be provided in the inlet line 94 if desired for cutting off the fuel supply to the heater summer months.

Further features and details of construction shown in the drawings will be described in connection with the description of the operation thereof including the operation of the electrical control circuit.

In operation, a timer switch 112 which may conveniently be mounted upon the instrument panel of the vehicle in which the heater is installed is set to turn the heater on at a predetermined time prior to the time at which it is expected to start the vehicle engine. The heater of the present invention is preferably designed for a relatively low heat output so that convection circulation of the engine coolant is sufficient to prevent the generation of steam in the water jacket 20, and, therefore, a preferably long time such as about thirty minutes, up to perhaps one hour is usually allowed for the heater to bring the engine coolant up to a desired temperature of say 120° to 180° F. The timer switch 112 may thus be set by the vehicle operator to start the heater 10 thirty minutes to one hour before he expects to start the engine.

As best shown in FIG. 5, the timer switch 112 is connected between the vehicle battery 114 and the electrically energizable portions of the heater. When the timer

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switch 112 closes, several things happen simultaneously. The exhaust fan 42 is directly energized and draws combustion air through the heater. The air inlet solenoid 66 is energized and opens the air inlet 60 at the bottom of the heater to permit combustion air to enter the heater in response to the suction created by the exhaust fan. The fuel pump 104 is energized to deliver fuel under pressure to the float valve 108. The fuel line solenoid valve 96 is energized and opens to the extent permitted by the adjustment screw 104, thus permitting fuel to flow from the float valve 108 into the vaporizing pot 72. The electrical igniter element 80, which is connected to the timer switch 112 through a special thermostatic switch 118 is energized and starts to heat up. And the solenoid valve 52 is energized to close the fluid circuit between the space heater 32 and the engine block 31.

A thermostatic control switch 122 is connected in the circuit between the timer switch 112 and the other elements of the heater for controlling the operation of the heater in response to the temperature of the engine coolant at the heater inlet. The thermostatic switch 122 is arranged in the conduit 22 at the heater inlet for sensing the temperature of the engine coolant as it enters the water jacket 20. The inlet conduit 22 is preferably connected to a point near the bottom of the engine block so that the thermostat 122 senses the temperature of the coldest coolant in the circuit. The thermostat is preferably adjusted to turn off the heater when the coolant reaches a temperature lower than the temperature at which the cooling system thermostatic valve (not shown) opens. In this way, the heat delivered by the heater 10 to the engine coolant is confined to the engine block 31 and is not dissipated by circulation of the warmed coolant through the radiator of the vehicle.

When the timer switch 112 closes, the various elements of the heater are energized. The fuel delivered to the vaporizing pot 72 starts to vaporize, and fuel vapor rises past the directing baffle 88 and into the mixing chamber defined by the shell 74. Vaporization of the fuel is facilitated by the suction fan 42, which, due to the restrictive effects of the air inlet apertures 62 and 86, reduces the atmospheric pressure in the vaporizing pot 72 to a value below the ambient pressure, and thus insures that adequate fuel vapors will rise about the electrical igniter element 80 even at severe low temperatures. The director baffle 88 directs the fuel vapor upon the electrical igniter 80 before the vapor comes into contact with the combustion air, and insures relatively rich combustion mixture at the surface of the igniter 80 for positive ignition even at low temperatures.

As soon as the igniter element 80 reaches its operating temperature, which normally takes but a few seconds, the combustion mixture within the mixing chamber ignites, and burning is initiated in the region adjacent to the electrical igniter 80. As combustion continues and the burner 12 becomes warmer, the rate of fuel vaporization increases. This effect is promoted both by conduction heating of the receptacle 68 and by direct radiation from the fire downwardly upon the fuel in the vaporizing pot 72. The flame rises higher as the rate of vaporization of the fuel increases, and during normal operation ordinarily rests near the top of the shell 74. At relatively high rates of fuel consumption, the flame may be based upon the re-igniter 90, and at relatively low rates usually starts a short distance below the re-igniter 90 and extends through it.

The thermostatic switch 118, which is connected in the energization circuit of the electric igniter 80 is arranged to sense the temperature of the shell 74, and to open, thereby de-energizing the igniter 80 when the shell 74 is sufficiently warm to indicate that the igniter fingers 92 are hot enough to maintain combustion. When, therefore, the heater is started and has warmed to an operating temperature, the electrical igniter 80 is de-energized,

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thus conserving the battery power of the vehicle. The heater continues to operate, warming the engine coolant in the water jacket 20 and circulating warm coolant through the engine block 31, until the coolant in the entire engine block is warmed to the preselected temperature at which the thermostat 122 in the coolant inlet line 22 opens, whereupon the thermostat 122 shuts off the heater. The heater then continues to cycle under control of the thermostat 122, operating intermittently to keep the engine coolant temperature within a range set by the opening and closing temperatures of the thermostat 122, until the timer switch 112 is opened.

The heater 130 illustrated in FIG. 6 is generally similar to the heater 10 illustrated in the preceding figures except for the change in orientation of the heat exchanger 14' and the provision of an elbow 132 between the burner 12 and the heat exchanger. This arrangement may be desired for use in certain installations where space requirements do not permit the vertical, in-line arrangement illustrated in FIGS. 1 and 3. The elbow 132 is preferably made of a highly refractory sheet metal material, such as, for example, stainless steel, and may be insulated if desired for maximum efficiency. It is provided with terminal flanges (not separately designated) enabling it to be fitted into the top of the burner housing 60 at one end and to receive the bottom flange 93 of the heat exchanger at its other end. The elbow 132 is secured firmly to the burner 12 and to the heat exchanger 14' by a pair of ring clamps 95 and 133, respectively, and forms the initial portion of the combustion chamber.

The heat exchanger 14', as illustrated, is in all respects similar to the vertically arranged heat exchanger 14 shown in FIG. 1, except that in order to insure adequate convection flow of the liquid being heated, the inlets 24' and 30' are arranged at the bottom of the heat exchanger, and the outlets 22' and 28' are arranged at the top. Preferably, also, for maximum heat transfer efficiency, the inlets 24' and 30' are disposed at the exhaust end of the heat exchanger to provide a maximum thermal gradient between the combustion gases and the liquid being heated near the point of discharge of the combustion gases from the heat exchanger.

It has been found that with the burner arrangement of the present invention combustion is relatively highly efficient and clean. A relatively lean fuel-air mixture is provided, and no secondary air is needed. The mixture ratio is controlled by fuel adjustment screw 104, and by adjustment or selection of the size of the outlet orifice 126 of the blower 122, which is adjustable in the illustrated embodiment, but which in production models would be fixed. The over-all full-air mixture is preferably very lean, and includes a relatively large proportion of air, thus insuring relatively complete combustion for efficient burning and clean operation. The use of a lean mixture is made possible even during the starting period when the burner is cold by the novel features of construction, which provide a relatively rich, readily ignitable mixture immediately adjacent to the igniter despite the over-all lean ratio. During starting, additional air beyond the quantity required to initiate combustion is mixed into the already ignited rich mixture to insure complete combustion. There is practically no soot deposit. The exhaust gases are substantially free of incomplete combustion products and have a high carbon dioxide ratio.

What is claimed is:

1. An auxiliary heater for use in a vehicle or the like of the type having a liquid cooled engine, said heater comprising a pot-type burner including means defining a mixing chamber having a fuel inlet and an air inlet and a combustion products outlet, means for supplying a fuel vapor to said chamber, means for supplying air to said chamber for mixture therein with the fuel vapor, said fuel vapor supply means including a pot for receiving and holding a vaporizable fuel at a predetermined level and suction means for reducing the pressure on fuel in

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said pot below the ambient thereby to increase its vaporization rate, electrical means for vaporizing said fuel in said pot, said suction means being operatable at least during the period when said vaporizing means is energized, and a heat exchanger connected to said burner at the combustion products outlet for transferring combustion heat to a circulatable fluid.

2. An auxiliary heater for use in a vehicle or the like of the type having a liquid cooled engine, said heater comprising a pot-type burner including means defining a mixing chamber having a fuel vapor inlet and an air inlet and a combustion products outlet, a vaporizing pot for receiving a liquid fuel and delivering fuel vapor to said mixing chamber at the fuel vapor inlet, means for supplying a liquid fuel to said pot at a regulatable rate such as to provide fuel at a predetermined level in said pot, an electrically energizable igniter mounted in said pot and extending therethrough into said combustion chamber, heat insulating means for insulating said igniter from liquid fuel in said pot and thereby minimizing the warm-up period of said igniter, a heat exchanger arranged at the combustion products outlet of said chamber for transferring heat of combustion to a circulatable fluid, means for isolating the flow of air into said heat exchanger so that combustion is accomplished solely with air that is mixed with the fuel vapor in said mixing chamber, power actuated suction draft means communicating with said combustion products outlet, and means for actuating said draft means when said igniter is energized thereby to reduce the pressure on the liquid fuel in said pot to increase its vaporization rate and to insure the creation of a combustible mixture in the igniter vicinity during starting of the burner at low temperatures.

3. An auxiliary heater for use in a vehicle or the like of the type having a liquid cooled engine, said heater comprising a pot-type burner including a generally cylindrical vertically disposed burner housing open at both ends and having a laterally facing air inlet aperture, means for maintaining said aperture open during operation of said burner and for closing it during nonoperating periods thereby to insure prompt snuffing of the fire when the burner is turned off, a perforated cylindrical shell disposed coaxially within said housing and defining a mixing chamber therein extending substantially the full length thereof, a pot supported at and closing the bottom of said housing, said pot being shaped to form a fuel vaporizing chamber opening upwardly into said mixing chamber and sealed off from the portion of said housing outside of said mixing chamber, passageway means including a closable valve for supplying a liquid fuel at a regulatable rate to said vaporizing chamber for vaporization therein, an electrical igniter element mounted in said pot and extending upwardly through said vaporizing chamber into said mixing chamber, a shield in said vaporizing chamber for shielding said igniter element from contact by liquid fuel and thereby minimizing heat loss from said igniter element to the liquid fuel in order to minimize the igniter element warm-up time, a radially inwardly projecting transverse baffle disposed at the upper edge of said vaporizing chamber for directing fuel vapor escaping therefrom radially inwardly toward said igniter and thereby providing a relatively rich fuel-air mixture in the immediate vicinity of the igniter element, a heat exchanger defining a closed combustion chamber sealed to the top of said burner housing and communicating with said mixing chamber, means for isolating the flow of combustion air into said combustion chamber so that air is only received in said chamber through said aperture in said housing, and power actuated suction draft means for providing a positive draft, communicating with said combustion chamber, said draft means being also effective to increase the vaporization of liquid fuel in said vaporizing chamber when the igniter element is energized by reducing pressure in said vaporizing chamber below the ambient pressure.

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4. An auxiliary heater for use in a vehicle or the like of the type having a liquid cooled engine, said heater comprising a pot-type burner including means defining a mixing chamber having a fuel vapor inlet and an air inlet and a combustion outlet, a vaporizing pot for receiving a liquid fuel and delivering fuel vapor to said mixing chamber at the fuel vapor inlet, means for supplying a liquid fuel to said pot at a regulatable rate such as to form a predetermined level of fuel in said pot, an electrically energizable igniter mounted in said pot and extending therethrough into said combustion chamber, heat insulating means for insulating said igniter from liquid fuel in said pot and thereby minimizing the warm-up period of said igniter, a heat exchanger arranged at the combustion outlet of said chamber for transferring heat of combustion to a circulatable fluid, means for isolating the flow of air into said heat exchanger so that combustion is accomplished solely with air that is mixed with the fuel vapor in said mixing chamber, power actuated suction draft means communicating with said combustion products outlet, and means for actuating said draft means during the warm-up period of said igniter thereby to reduce the pressure on the liquid fuel in said pot to increase its vaporization rate and to insure the creation of a combustible mixture in the igniter vicinity during starting of the burner at low temperatures, control means for alternately turning said burner on and off in response to temperature changes of the circulatable fluid being heated thereby, and temperature responsive control means for de-energizing said igniter during times when combustion is supportable in said burner without the igniter being energized.

5. A pot-type burner comprising a vertical shell having a perforate side wall defining a mixing chamber, a cup-shaped vaporizer connected to the bottom of said side wall and opening upwardly into the chamber defined thereby, means for supplying a vaporizable liquid fuel to said cup-shaped vaporizer at a regulatable rate such that fuel is maintained at a predetermined level in said pot, an igniter element mounted on said cup-shaped vaporizer and extending upwardly above the open upper end thereof, and a shield arranged around said igniter element for shielding said igniter element from liquid fuel contained in said cup-shaped vaporizer, the height of the shield being substantially the same as the height of the cup-shaped vaporizer.

6. An auxiliary heater for use in a vehicle or the like of the type having a liquid cooled engine, said heater comprising a pot-type burner including a generally cylindrical vertically disposed burner housing open at both ends, a perforated open-ended cylindrical shell disposed coaxially within said housing and defining a mixing chamber therein extending substantially the full length thereof, a pot supported at and closing the bottom of said housing, said pot being shaped to form a fuel vaporizing chamber opening upwardly into said mixing chamber and sealed off from the interior of said housing surrounding said mixing chamber, passageway means including a closable valve for supplying a liquid fuel at a regulatable rate to provide a predetermined level of fuel in said pot for vaporization therein, an electrical igniter element mounted in said pot and extending upwardly through said vaporizing chamber into said mixing chamber, a shield in said vaporizing chamber for shielding said igniter element from contact by liquid fuel and thereby minimizing heat loss from said igniter element to the liquid fuel in order to minimize the igniter element warmup time, a heat exchanger defining a closed combustion chamber sealed at one end to the top of said burner housing and communicating with the mixing chamber, and power actuated suction draft means communicating with said combustion chamber and associated with the other end of said heat exchanger for providing a positive draft, said draft means being also effective to increase the vaporization of liquid fuel in said vaporizing chamber when the igniter element is energized

by reducing the pressure in said vaporizing chamber below the ambient pressure.

7. An auxiliary heater for use in a vehicle or the like of the type having a liquid cooled engine, said heater comprising a pot-type burner including a generally cylindrical vertically disposed burner housing open at both ends and having an air inlet aperture, solenoid-operated means for maintaining said aperture open during operation of said burner and for closing it during non-operating periods thereby to insure prompt snuffing of the fire when the burner is turned off, a perforated cylindrical shell disposed coaxially within said housing and defining a mixing chamber therein extending substantially the full length thereof, a pot supported at and closing the bottom of said housing, said pot being shaped to form a fuel vaporizing chamber opening upwardly into said mixing chamber and sealed off from the portion of said housing outside of said mixing chamber, passageway means including a closable valve for supplying a liquid fuel at a regulatable rate to said vaporizing chamber for vaporization therein, an electrical igniter element mounted in said pot and extending upwardly through said vaporizing chamber into said mixing chamber, a shield in said vaporizing chamber for shielding said igniter element from contact by liquid fuel and thereby minimizing heat loss from said igniter element to the liquid fuel in order to minimize the igniter element warm-up time, a heat exchanger defining a closed combustion chamber sealed to the top of said burner housing and communicating with said mixing chamber, means for isolating the flow of combustion air into said combustion chamber so that air is only received in said chamber through said aperture in said housing, and power actuated suction draft means communicating with said combustion chamber and associated with the other end of said heat exchanger for providing a positive draft, said draft means being also effective to increase the vaporization of liquid fuel in said vaporizing chamber when the igniter element is energized by reducing the pressure in said vaporizing chamber below the ambient pressure.

8. A pot-type burner comprising a vertical shell having a perforate side wall defining a mixing chamber, a cup-shaped vaporizer connected to the bottom of said side wall and opening upwardly into the chamber defined thereby, a burner housing surrounding and spaced from said shell and sealed at its lower end to said vaporizer, said housing having an air inlet therethrough forming the sole passage for air for combustion, means for supplying a vaporizable liquid fuel to said cup-shaped vaporizer at a regulatable rate such as to form a predetermined level of fuel in said vaporizer, an igniter element mounted on said cup-shaped vaporizer and extending upwardly above the open upper end thereof, a shield arranged around said igniter element for shielding said igniter element from liquid fuel contained in said cup-shaped vaporizer, the height of the shield being substantially the same as the height of the cup-shaped vaporizer, and means for reducing the pressure within said cup-shaped vaporizer to a value below the ambient during operation of said burner thereby to increase the vaporization of a liquid fuel supplied to said cup-shaped vaporizer.

9. An auxiliary heater for use in a vehicle or the like of the type having a liquid cooled engine, said heater comprising a vertically disposed burner housing open at both ends, a perforated cylindrical shell disposed coaxially within said housing and defining a mixing chamber, a pot supported from and closing the bottom of said housing, said pot being shaped to form a fuel vaporizing chamber opening upwardly into said mixing chamber and sealed off from the interior of said housing surrounding said mixing chamber, said burner housing having an air inlet passage extending therethrough through which air may be drawn into the area surrounding said shell, solenoid operated means for maintaining said air inlet passage open during operation of said burner and for closing said air inlet passage during non-operating periods thereby to insure prompt snuffing of the fire when the burner is turned off, passageway means through which liquid fuel may be supplied to said pot at a regulatable rate to provide a predetermined level of fuel in said fuel vaporizing chamber, fuel pump means for supplying fuel to said passageway means, a solenoid operated fuel valve for opening and closing said passageway means, vaporizing means in said pot for vaporizing the fuel therein, a heat exchanger defining a closed chamber sealed at one end to the top of said burner housing and communicating with said mixing chamber, and electrically operated power actuated suction draft means associated with the other end of said heat exchanger and communicating with said combustion and mixing chambers for providing a positive draft and increasing the vaporization of liquid fuel in said vaporizing chamber.

10. The combination set forth in claim 9 wherein said solenoid operated means for controlling said air inlet passage in said burner housing comprises a damper, a spring normally urging said damper into closed position and a solenoid adapted to open said damper against the yielding action of said spring.

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