Oct. 7, 1941. S. MORICI ET AL 2,257,756

HEATER

Filed Oct. 7, 1940 2 Sheets-Sheet 1

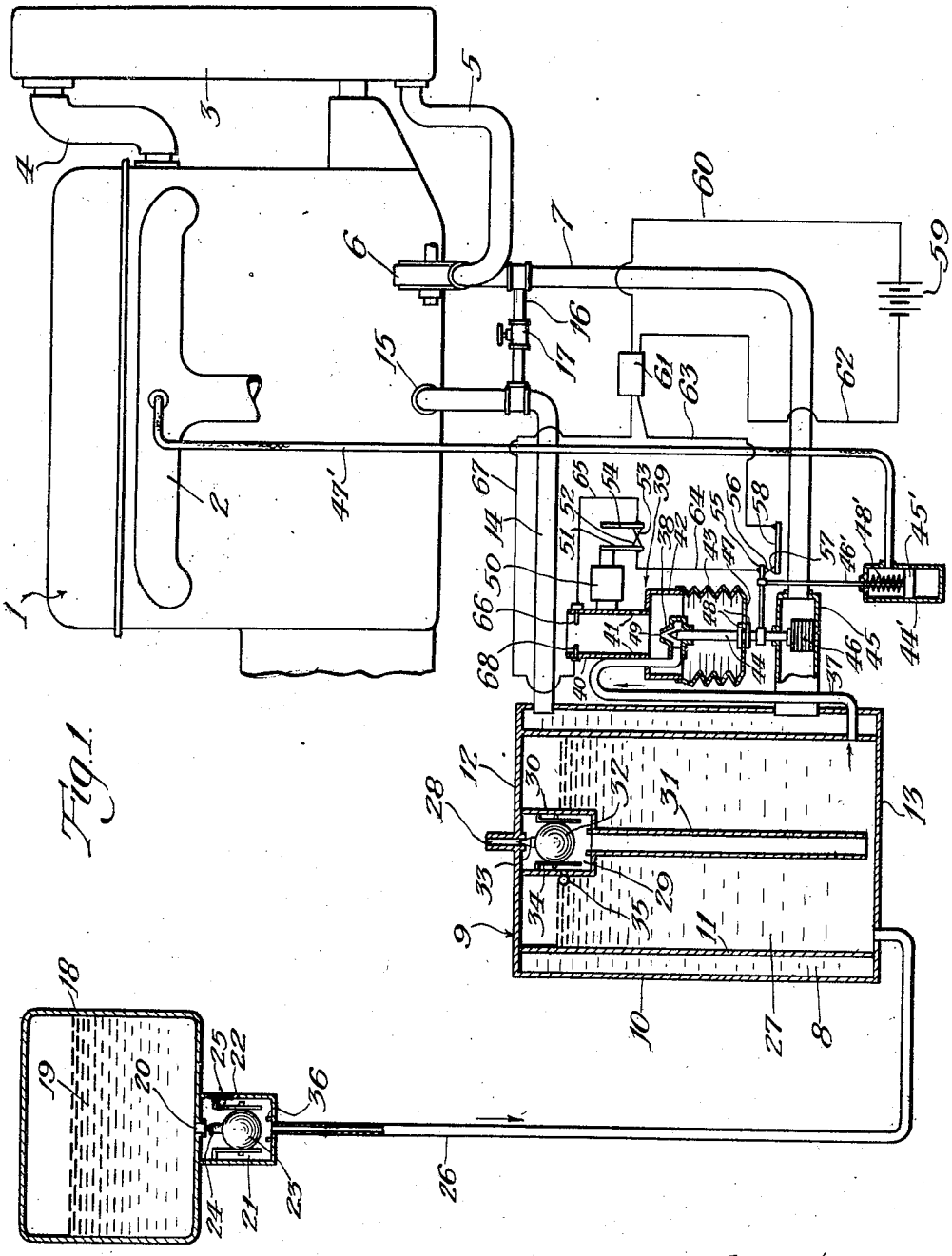


Fig. 1.

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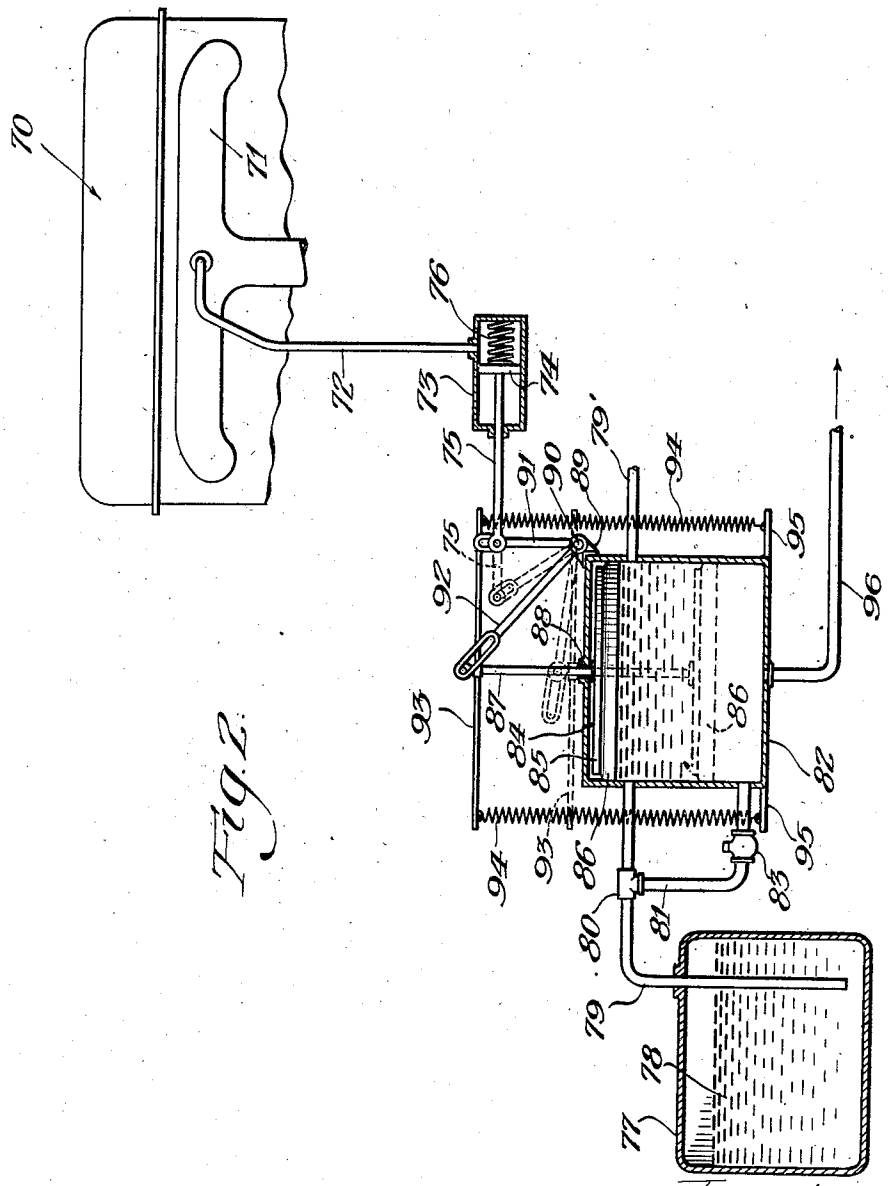


Fig. 2.

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HEATER

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9 Claims. (Cl. 123—174)

This invention relates to improvements in means for automatically establishing pressure upon a body of liquid fuel for the purpose of passing said fuel under pressure to a burner.

In one of the specific aspects of our invention, a field in which our invention is ideally adapted, the invention contemplates means for automatically maintaining the cooling water of an internal combustion engine at a relatively constant predetermined temperature, preferably in the neighborhood of the normal operating temperature of said cooling water, the arrangement being such that the predetermined constant cooling water temperature is maintained during periods when the engine is inoperative.

The objects and advantages of our invention will be apparent from the accompanying drawings and following detailed description.

In the drawings,

Fig. 1 is a diagrammatic view of one form of our invention, as applied to an internal combustion engine.

Fig. 2 is a diagrammatic view of a modification of our invention.

Referring in detail to the drawings, 1 indicates a conventional water cooled internal combustion engine having an intake manifold 2. A radiator 3 is associated with the engine 1 and the upper portion of said radiator is connected to the water jacket of the engine by means of the pipe 24. A discharge pipe 5 connects into the lower portion of the radiator 3 at one end and connects into a conventional water pump 6 at the opposite end, the pipe 5 comprising the intake to the pump 6. The pump 6 is of conventional construction and is driven by any suitable means from the internal combustion engine 1.

Pipe 7 comprises the discharge pipe of pump 6 and water drawn from the radiator 3 by means of pump 6 is discharged through the pipe 7. The pipe 7 connects into a water jacket 8 of container 9. The container 9 is provided with outer lateral walls 10 and spaced inner lateral walls 11, the walls 10 and 11 defining the jacket 8 into which water from the pump 6 is discharged. The container 9 is also provided with a top 12 and bottom 13. A pipe 14 connects into the upper portion of the jacket 8 at one end and at the opposite end connects into the water jacket of the internal combustion engine as at 15. A pipe 16 connects pipe 7 to pipe 14, pipe 16 carrying a valve 17. By closing valve 17 all of the water from the pump 6 is diverted from pipe 7, jacket 8 and pipe 14. If valve 17 is open the major portion of the water short circuits the jacket 8 and passes directly from pipe 7 to pipe 14 and into the water jacket of the engine 1.

A fuel supply tank 18 adapted to carry a bulk supply 19 of gasoline is associated with the engine 1. The tank 18 is provided with an opening 20 at its bottom, said opening communicating with a compartment 21, defined by walls 22 mounted upon the lower portion of the tank 18. A float 23 is positioned in the compartment 21 and carries at its upper end a valve pin 24. The float 23 is adapted for vertical movement within the compartment 21 and is guided by means of guides 25 so as to center the pin 24 with the opening 20.

A pipe 26 connects the lower portion of the compartment 21 to the interior 27 of the container 9.

The top 12 of the container 9 is provided with an opening 28, a compartment 29 defined by walls 30 is provided immediately beneath the opening 28, the walls 30 being secured to the under surface of the top 12. A pipe 31 communicates with the compartment 29 and extends downwardly into the compartment 27, said pipe being open at its lower end and is positioned adjacent the bottom 13 of the container. A float 32 is positioned within the compartment 29 and carries a pin 33 at its upper portion. The float 32 is adapted for vertical movement within the compartment 29 and guides 34 are provided within the compartment 29 whereby the pin 33 may be centered with the opening 28. A check valve 35 is positioned in an opening in the wall 30 which permits communication from the compartment 29 to the compartment 27, communication in the opposite direction being prevented.

When gasoline 19 is introduced into the tank 18, said gasoline flows through the opening 20 into the compartment 21. Pins 36 are positioned at the lower portion of the compartment 21 and prevent the float 23 from closing the upper portion of the pipe 26. The gasoline therefore passes downwardly through pipe 26 and into compartment 27. As the gasoline passes into compartment 27 the level of the gasoline in pipe 31 follows the level of the gasoline in the main portion of the compartment 27. As the gasoline moves above the lower portion of the compartment 29, the float 32 begins to raise and eventually the pin 33 sets in the aperture 28. When this occurs, further introduction of gasoline from the tank 18 causes compression of the atmosphere above the level of the gasoline in the compartment 27 and eventually the head of gasoline from

tank 18 is balanced by the pressure within the compartment 27 and a condition of equilibrium is established.

A pipe 37 connects at one end into the lower portion of compartment 27. At the opposite end pipe 37 connects into jet 38. The jet 38 comprises a portion of fuel burner 39. The burner 39 is provided with a tubular member 40 which is open at both ends, the lower portion of the tubular member being provided with apertures 41 for the introduction of air into the tubular member 40. At its lower end the tubular member is mounted upon an inverted cup-like element 42 which is connected by means of a corrugated metallic element 43 to a pin 44.

Pipe 7 connecting the water pump 6 to the jacket 8 is relatively enlarged as indicated at 45 adjacent its point of connection into the jacket 8. Within the enlarged portion 45 of the pipe 7, a thermostat 46 is positioned, the upper portion of the thermostat being connected to rod 44 which projects upwardly through the enlarged portion 45 of pipe 7. The corrugated element 43 forms a portion of a cup-like member, the corrugations comprising the lateral walls of the cup. The bottom 47 of said cup-like member is connected by flanges 48 to an intermediate portion of the rod 44.

The operation of the thermostat 46 is such that when it is heated it expands and moves the rod 44 upwardly. However, in view of the fact that the bottom 47 is rigidly connected to the rod 44, said bottom also moves upwardly. The remaining portion of the burner 39 is stationary and, consequently, the upward movement of the bottom 47 tends to compress the corrugations 43 which permit relative movement of the rod 44 with respect to the upper portion of the burner. The upper end of rod 44 passes into the jet 38 and upward movement of the rod 44 tends to close aperture 49 provided in the jet 38. Consequently, when the thermostat 46 has been heated to a predetermined degree, the rod 44 will close the aperture 49 and no fuel will pass from the pipe 37 into the tubular portion 40 of the burner. In view of the fact that the thermostat 46 is responsive to the temperature of the water passing from the pump 6, the movement of the rod 44 in response to variations of water temperature, tends to control the amount of fuel which is passed through the jet 38.

In order to insure the closing of the opening 49 when the internal combustion engine is in operation, a vacuum cylinder 44' carrying piston 45' which is slidably positioned in the cylinder, is mounted adjacent the burner. A piston rod 46' is carried by piston 45' and is connected with arm 55. A pipe 47' connects the intake manifold 2 and the upper portion of cylinder 44', whereby operation of engine 1 causes a vacuum in the intake 2, thereby moving piston 45' upwardly, as viewed in Fig. 1. Upward movement of the piston moves pin 44 upwardly thereby closing the opening 49, preventing further heating of the water by the burner. A spring 48' is confined between the upper portion of the piston 45' and the cylinder end and functions to urge the piston downwardly when the vacuum in the cylinder is broken, thereby permitting movement of pin 44 in response to thermostat 46.

A thermostat 50 of conventional construction is mounted upon the outer surface of the tubular member 40 and is responsive to the temperature of said tubular member. The thermostat 50 carries an arm 51 which in turn supports a contact point 52 which is adapted to cooperate with an adjacent contact point 53 carried by an arm 54. An arm 55 is carried upon an intermediate portion of rod 44, said arm carrying a contact point 56 which cooperates with an adjacent contact point 57 carried by an arm 58.

A battery 59, which may comprise the storage battery utilized in conjunction with the internal combustion engine, is connected by lead 60 to a conventional spark coil 61. The opposite side of the battery 59 is also connected to the spark coil 61 by means of lead 62, the leads 60 and 62 constituting the low tension leads to the spark coil. One of the high tension leads of the spark coil designated 63, connects to arm 58. A lead 64 connects arm 55 to arm 51 and a lead 65 connects arm 54 to an electrode 66 which projects into the interior of the tubular space defined by the tubular space defined by the tubular member 40. The opposite high tension lead 67 from the spark coil 61 connects with an electrode 68 which is positioned oppositely to electrode 66, the electrodes 66 and 68 providing a spark gap between their ends. The gap between the electrode 66 and 68 is immediately above and in alignment with the aperture 49 of jet 38.

In operation assume that the engine 1 comprises the engine of an automobile which is being driven in relatively low temperature weather. If the motorist stops the automobile and renders the engine inoperative, the cooling water in the internal combustion engine system soon becomes cold. Experience indicates that difficulty is frequently encountered in starting the engine after it has become cold. Utilizing the present invention, however, operation of the internal combustion engine heats the water within the cooling system, and inasmuch as said water passes through the jacket space 8, heat is imparted to the gasoline or other fuel which is positioned in the compartment 27. After the fuel within the compartment 27 is heated, a portion of said fuel vaporizes and the pressure of the atmosphere above the level of the fuel within the compartment increases. With this increase in pressure there is a tendency to discharge fuel backwardly through the pipe 26. However, motion of the fuel upwardly in pipe 26 causes float 23 to move upwardly whereby pin 24 closes the aperture 20 and prevents "back-up" of fuel from the compartment 27 to the tank 18. It can readily be seen, however, that the fuel within the compartment 27 is under superatmospheric pressure During operation of the engine 1 the temperature of the cooling water is maintained at its normal operating temperature. The thermostat 46 is so adjusted that when the water in the cooling system is at its normal operating temperature, the aperture 49 in the jet 38 is closed. Consequently, during the operation of the engine 1, no fuel is passed through the pipe 37 and discharged from the jet 38.

Assume, now, that the automobile is stopped and the engine rendered inoperative. When such condition takes place the water temperature begins to drop. When the temperature of the cooling water has lowered a predetermined degree, contact point 56 makes the electrode contact with the contact point 57 and, hence, closes the high tension circuit of the spark coil 61, thermostat 50 being so adjusted that when in relatively cold condition contact points 52 and 53 are closed.

At this stage a spark is produced between the electrodes 66 and 68. Of course, the movement of the thermostat 46 which permitted the contact

points 56 and 57 to close, also caused the rod 44 to move downwardly and open aperture 49. The fuel 27 being at superatmospheric pressure is forced through the opening 49 of the jet 38 and is ignited by the spark produced at the spark gap.

It can readily be seen that the flame produced in the cylinder 40 is immediately beneath the pipe 14 and consequently the water in said pipe is heated by the flame. It can also be readily seen that when flame is produced at the burner the thermostat 50 is heated and as a consequence the points 52 and 53 separate and break the high tension circuit causing a discontinuance of the spark between the electrodes 66 and 68. As the flame continues the temperature of the water is increased and as this action takes place the thermostat 46 tends to expand thereby decreasing the flame at the burner. It can readily be seen that by proper adjustment of the rod 44 in conjunction with thermostat 46, the water temperature can be maintained substantially constant.

When the engine 1 is again started the water temperature reaches its normal operating condition and, consequently, as long as the engine is maintained in operation no flame will be produced at the burner. When no flame is produced at the burner the thermostat 50 causes the contact points 52 and 53 to close and, hence, the system is in readiness for the next stoppage of the engine.

As fuel is withdrawn from the compartment 27 the liquid level of the fuel within said compartment lowers. However, in view of the fact that the compartment 27 is always surrounded by substantially hot water, the pressure within the compartment 27 is maintained substantially constant and the pin 33 will not be removed from the opening 28 unless a substantial equilibrium of pressure exists between the interior of the compartment 27 and the exterior thereof, which will only be the case when the fuel within the compartment 27 reaches a very low level. At this time the pin 24 is unseated and more fuel passes from the tank 18 to the compartment 27.

Referring in detail to Fig. 2 of the drawings, a modification of our invention is shown as applied to an internal combustion engine. 70 indicates a conventional water cooled internal combustion engine having an intake manifold 71. A pipe 72 connects into the manifold 71 and at its opposite end connects into the interior of cylinder 73. A piston 74 carried by a piston rod 75 is slidably positioned within the cylinder 73. A coil spring 76 is confined between the head of the cylinder and the piston and normally urges said piston outwardly.

The arrangement is such that when the internal combustion engine is in operation, a condition of vacuum is set up in the intake manifold 71. Vacuum is established within the cylinder 73 between the piston and the head of said cylinder whereby the piston 74 is retracted against the impulse of spring 76. When the internal combustion engine 70 is rendered inoperative, spring 76 tends to move piston 74 outwardly.

A fuel tank 77 is employed to carry a bulk supply of gasoline 78. A pipe 79 connects into the upper portion of the fuel tank 77 and is provided with an open end which is disposed adjacent the lower portion of the tank. A T-coupling 80 is connected in pipe 79 and a branch pipe 81 connects into said coupling. The pipe 79 connects into the interior of a container 82 adjacent the upper portion of said container. Pipe 81 also connects into the container 82 adjacent the lower portion of said container. A check valve 83 is connected in pipe 81 and opens towards the container 82. However, the check valve 83 prevents passage of liquid from the container 82 through the pipe 81.

A piston 84 is slidably positioned within the container 82, said piston comprising a disc 85 carrying a flexible washer or flange 86. The flange or washer 86 is preferably constructed of leather, "Neoprene," "Thiokol," or other flexible material which is not deleteriously affected by gasoline. A piston rod 87 is connected to the disc 85 and extends upwardly from said disc through an opening 88 provided in the upper end of the container 82. A lug 89 is mounted upon the upper portion of the container 82 and a bell crank lever is journalled in said lug as at 90. One arm 91 of the bell crank lever is pivotally connected to the end of the piston rod 75. The other arm 92 of the bell crank lever is pivotally connected to the end of the piston rod 87.

The arrangement is such that when the piston rod 75 is moved outwardly or inwardly, the bell crank lever is rocked about the pivot 90. When the piston rod 75 moves inwardly into the cylinder 73, the piston 84 is raised within the container 82. When the piston rod 75 moves outwardly from the cylinder 73 the piston 84 is moved downwardly or inwardly into container 82. The arms 91 and 92 of the bell crank lever are provided with suitable slots at their ends to compensate for the angularity of movement of the rods 75 and 87.

A transverse support 93 is mounted upon the upper portion of the piston rod 87 and coil springs 94 are anchored upon opposite ends of said rod. At the opposite ends of the coil springs 94 said springs are anchored upon lugs 95 carried at the lower portion of the container 82.

The arrangement is such that when the internal combustion engine is set into operation the piston 74 is drawn into cylinder 73. This action causes piston 84 to raise within the container 82. A suction is thereby established in pipes 81 and 79 and liquid fuel 78 is drawn through said pipes into the container 82. Simultaneously with the raising of the piston 84, springs 94 are stretched and a predetermined degree of potential energy is established in said springs. However, so long as the internal combustion engine is in operation, the piston 84 is maintained in raised position and will not descend under the influence of the springs 94.

A pipe 96 connects into the lower portion of container 82 at one end and at the opposite end may connect into a burner similar to the burner 39 hereinbefore described, the burner functioning in the same manner as the burner 39, that is, to maintain the cooling water of the internal combustion engine at a predetermined temperature. Obviously, when the engine 70 is in operation and the piston 84 is in its upper position, no pressure is established on the liquid within the container 82 and, consequently, no liquid under pressure is passed through the pipe 96 to the burner. Obviously, at this phase of the operation of the device it is unnecessary to have the burner in operation since the cooling water is being properly heated by the internal combustion engine operation. However, when the engine 70 is rendered inoperative, a condition of vacuum is no longer established in the cylinder 73, and the piston 84 is free to descend under the influence of the springs 94. By the

provision of the flexible washer 86, the liquid within the container 82 is prevented from passing the piston. As the piston 84 descends under the influence of springs 94, liquid fuel from the container 82 is passed backwardly into the tank 77 through the pipe 79. However, due to the presence of the check valve 83, no liquid passes from the container 82 through the pipe 81. Hence, when the piston 84 has descended below the point of communication of pipe 79 with container 82, a condition of pressure is established upon the liquid within the container 82 and, consequently, fuel under pressure is forced through the pipe 96 to the burner and is utilized in the burner in the manner hereinbefore described in conjunction with burner 39.

Of course, it is to be understood that as many springs 94 may be employed as are necessary to produce the desired degree of pressure upon the liquid passed to the burner. In addition, we do not wish to be limited to the specific arrangement illustrated for lifting the piston 84 since this can be accomplished by hand or can be accomplished by any type of linkage or mechanism which will associate a vacuum cylinder with the piston 84.

Broadly, our invention can be utilized for other purposes than the maintenance of the cooling water at a predetermined temperature. For instance, pressure established in the mechanism illustrated in Fig. 2 may be utilized in conjunction with oil stoves or the like wherein it is desired to force liquid fuel under pressure to a burner.

In conjunction with the specific application of our invention to an internal combustion engine, the pressure container 82 may be interposed in the fuel pipe line between the supply tank of the automobile and the fuel pump of the automobile. In this case it need only be necessary to interpose the container 82 in the pipe 79 and a continuation 79' of said pipe may connect directly to the fuel pump (not shown) of the automobile. Obviously, while the engine 70 is in operation, the piston 84 is in raised position and, consequently, there is a free passage of fuel from the fuel tank through the pipe 79, container 82 and pipe 79' to the fuel pump.

We claim as our invention:

1. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for passing liquid fuel from said tank to said container, means carried by said pressure container for subjecting said liquid fuel in said container to superatmospheric pressure, a fuel burner in heating relationship with the cooling water of an internal combustion engine, means for passing liquid fuel under superatmospheric pressure from said container to the burner, means responsive to the temperature of the cooling water for controlling the passage of fuel to said burner.

2. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for passing liquid fuel from said tank to said container, a container for engine cooling water in heat interchange relationship with said pressure container whereby the heat of said water causes vaporization of a portion of fuel in said pressure container to establish a condition of superatmospheric pressure in said pressure container, connections into said water container from the internal combustion engine cooling system, a burner disposed in heating relation with the water in said cooling system, said burner being in communication with the lower portion of said pressure container whereby liquid fuel from said pressure container is passed to said burner, and thermostatic means for controlling the passage of liquid fuel from said pressure container to the burner.

3. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for passing liquid fuel from said tank to said container, a container for engine cooling water in heat interchange relationship with said pressure container whereby the heat of said water causes vaporization of a portion of fuel in said pressure container to establish a condition of superatmospheric pressure in said pressure container, connections into said water container from the internal combustion engine cooling system, a burner disposed in heating relation with the water in said cooling system, said burner being in communication with said pressure container whereby liquid fuel from said pressure container is passed to said burner, and thermostatic means for controlling the passage of liquid fuel from said pressure container to the burner.

4. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for passing liquid fuel from said tank to said container, a water jacket carried by said pressure container, means connecting said water jacket to the cooling water system of an internal combustion engine whereby heat from said cooling water passes to the liquid fuel in said pressure container and causes a condition of superatmospheric pressure therein, a burner disposed in heating relation with the water in said cooling system, means connecting said burner and the pressure container whereby liquid fuel under pressure passes to said burner, and thermostatic means for controlling the passage of liquid fuel from said pressure container to the burner.

5. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for passing liquid fuel from said tank to said container, a water jacket carried by said pressure container, means connecting said water jacket to the cooling water system of an internal combustion engine whereby heat from said cooling water passes to the liquid fuel in said pressure container and causes a condition of superatmospheric pressure therein, a burner disposed in heating relation with the water in said cooling system, means connecting said burner and the pressure container whereby liquid fuel under pressure passes to said burner, and thermostatic means responsive to the temperature of the cooling water for controlling the passage of liquid fuel from said pressure container to the burner.

6. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for passing liquid fuel from said tank to said container, a piston slidably posi-

tioned in said pressure container, a burner, connections between said pressure container and said burner, and means for passing liquid fuel under pressure from said container to said burner which comprises resilient means for moving said piston into contact with the liquid fuel in said container, said burner being in heating relationship with the cooling water system of an internal combustion engine.

7. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for passing liquid fuel from said tank to said container, a piston slidably positioned in said pressure container, a burner, connections between said pressure container and said burner, and means of passing liquid fuel under pressure from said container to said burner which comprises a spring for moving said piston into contact with the liquid fuel in said container, said burner being in heating relationship with the cooling water system of an internal combustion engine.

8. A heater for the cooling water of an internal combustion engine which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for drawing liquid fuel from said tank to said pressure container comprising a piston slidably movable in said pressure container to create a vacuum therein, a piston rod carried by said piston, resilient means associated with said piston rod to urge said piston into said container to exert pressure on the liquid therein, a burner, a connection between said container and said burner whereby liquid fuel under pressure is passed from said container to said burner, and means carried by the burner for controlling the passage of liquid fuel to the burner.

9. A heater for the cooling water of an internal combustion engine having an intake manifold, which comprises in combination, a tank for carrying a bulk supply of liquid fuel, a pressure container for carrying liquid fuel, means for drawing liquid fuel from said tank to said pressure container comprising a piston in said container, a piston rod carried by said piston, a vacuum cylinder connected to said intake manifold, a piston positioned in said vacuum cylinder, a piston rod carried by said piston, and means connecting the said two piston rods together whereby operation of the internal combustion causes movement of the pressure container piston within the pressure container, resilient means associated with the pressure container piston rod to urge said piston into said container to exert pressure on the liquid therein, a burner, a connection between said container and said burner whereby liquid fuel under pressure is passed from said container to said burner, and means carried by the burner for controlling the passage of liquid fuel to the burner.

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