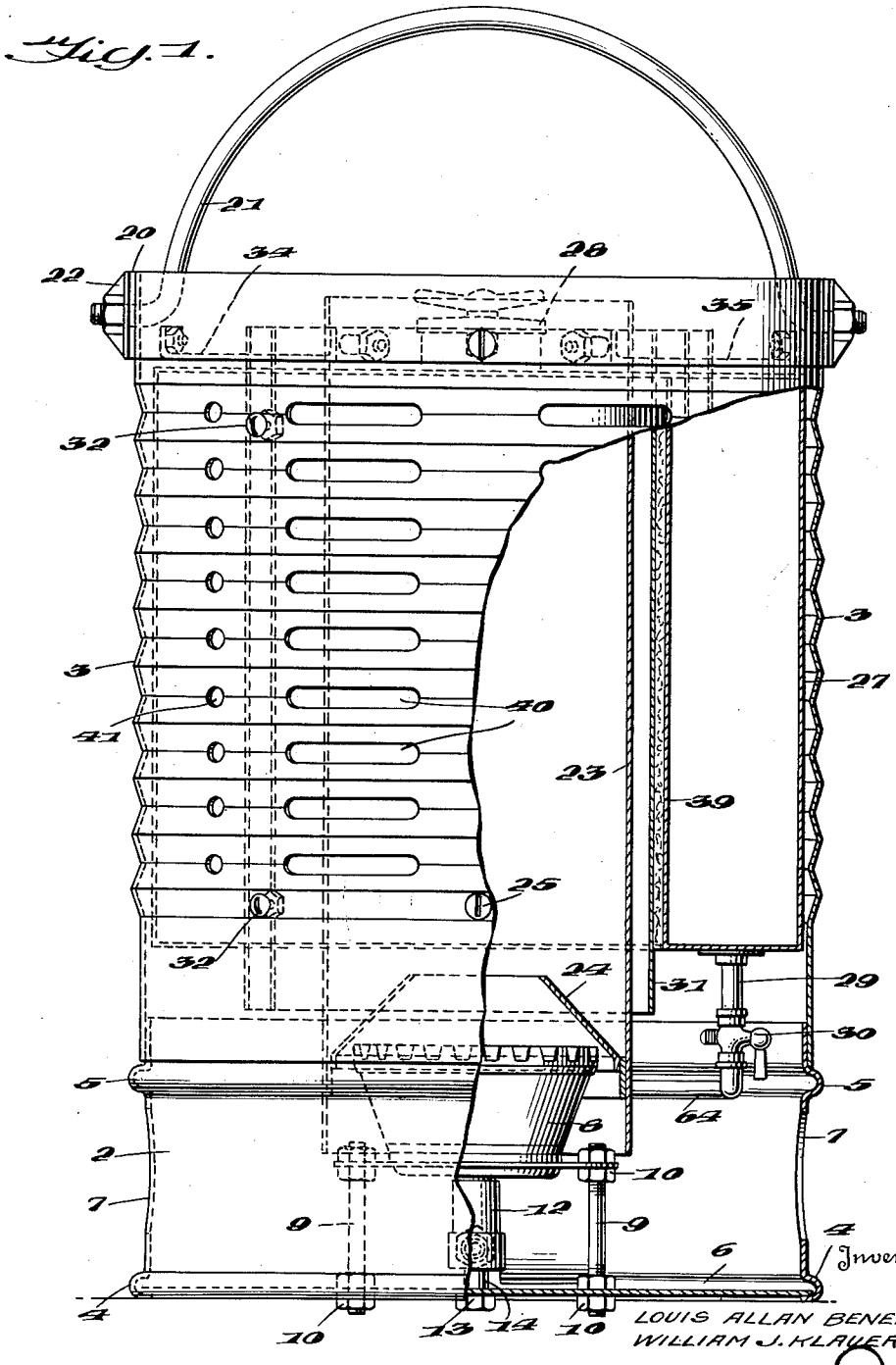
Jan. 15, 1952 L. A. BENEDICT ET AL 2,582,900

ALCOHOL HEATER FOR REFRIGERATOR CARS

Filed May 10, 1946 5 Sheets-Sheet 1

Fig. 1.




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ALCOHOL HEATER FOR REFRIGERATOR CARS

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Fig. 2.

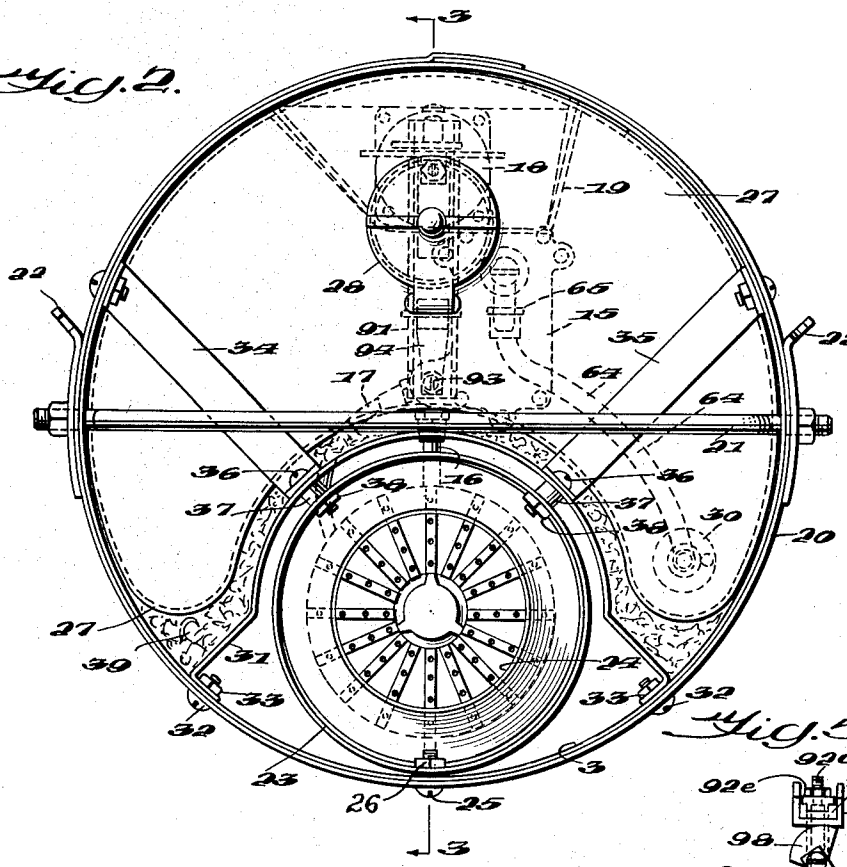



Fig. 5.

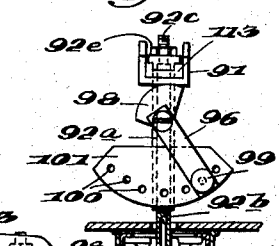
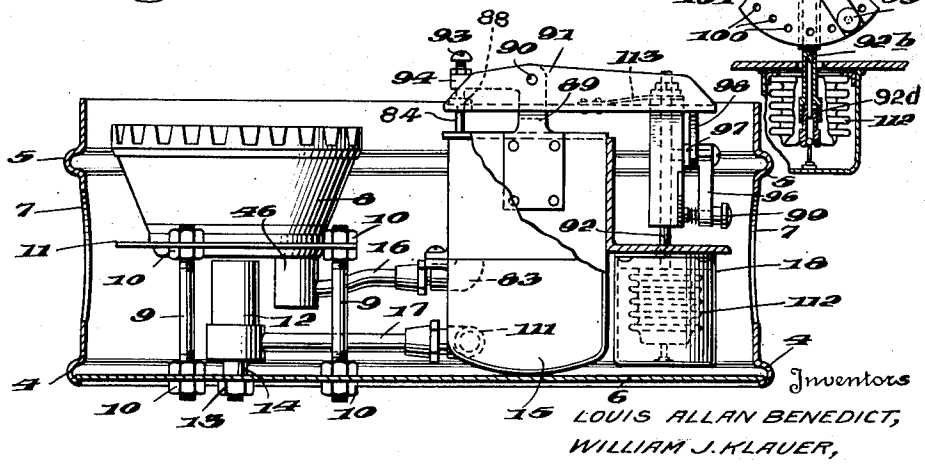



Fig. 3.




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ALCOHOL HEATER FOR REFRIGERATOR CARS

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Fig. 4.

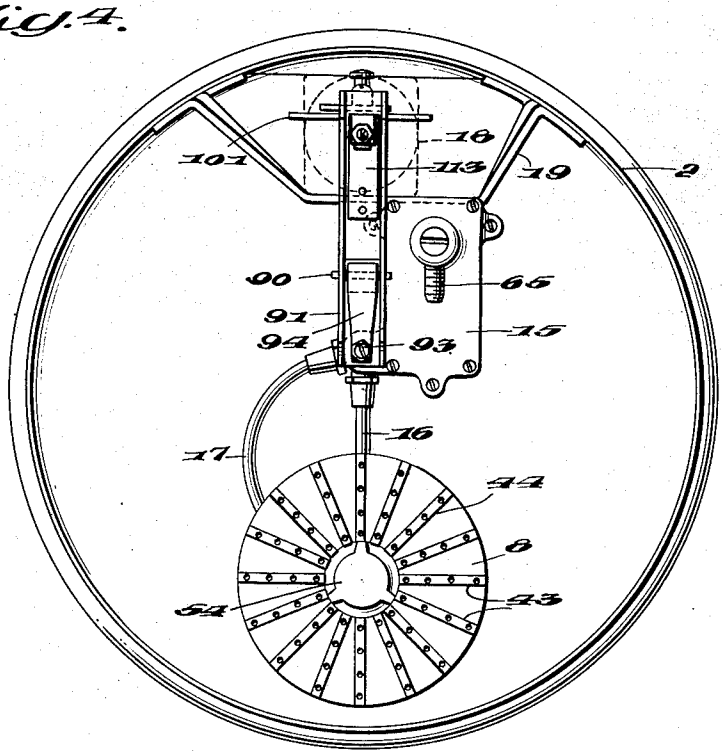
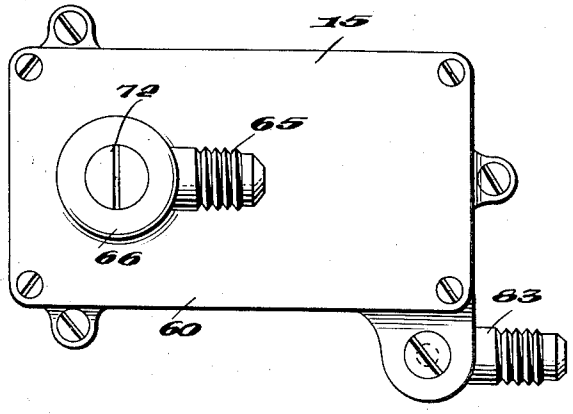



Fig. 10.




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ALCOHOL HEATER FOR REFRIGERATOR CARS

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Fig. 6.

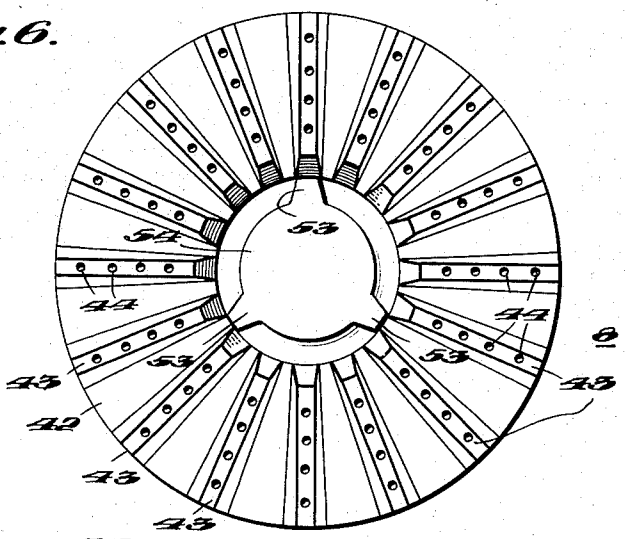
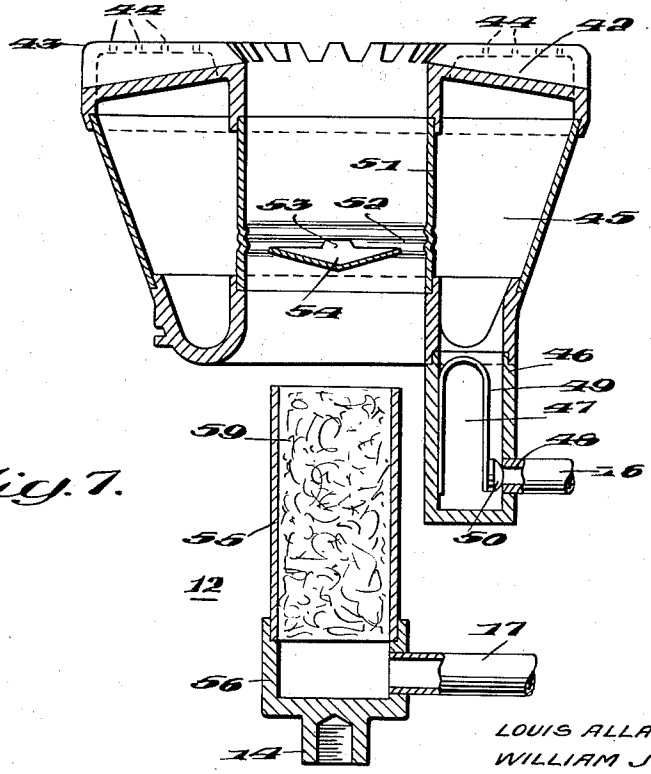



Fig. 7.




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ALCOHOL HEATER FOR REFRIGERATOR CARS

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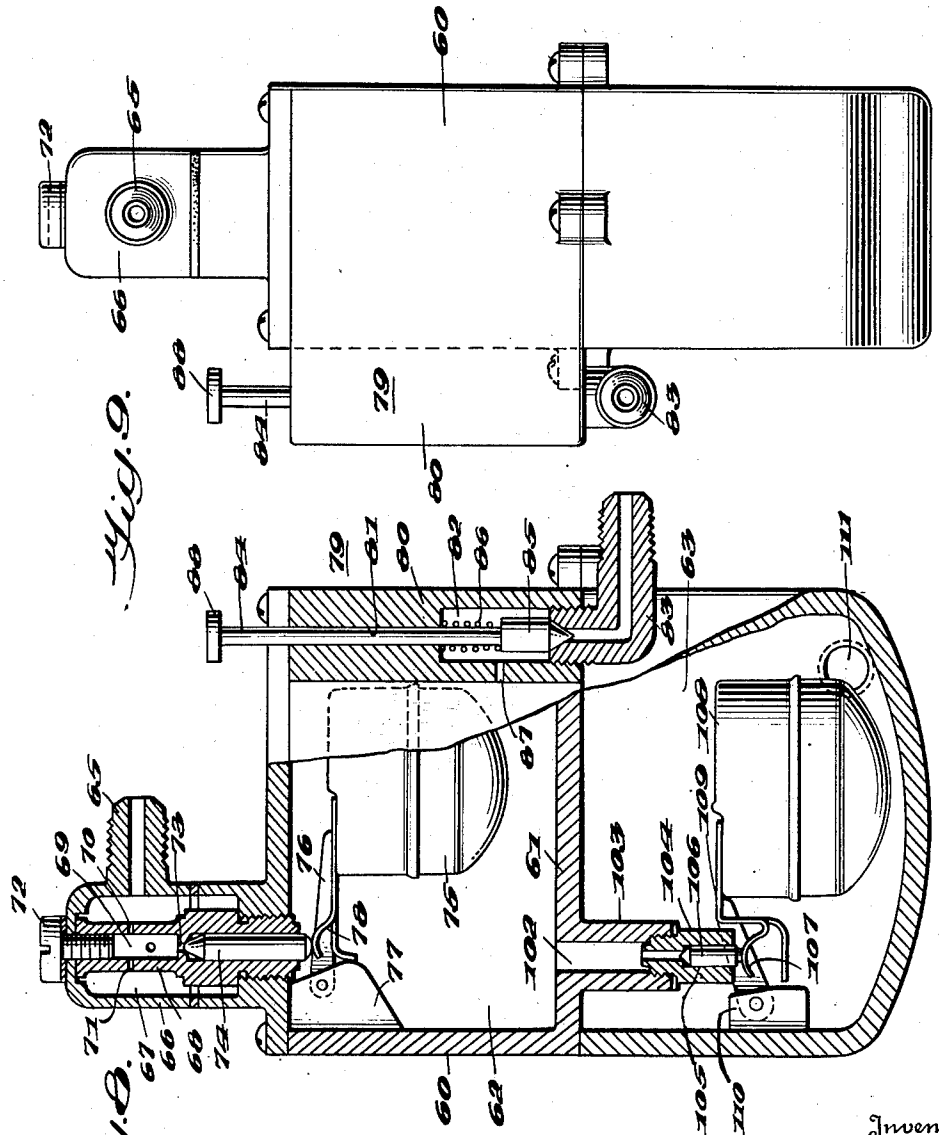


Fig. 9.



Fig. 8.

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# UNITED STATES PATENT OFFICE

2,582,900

## ALCOHOL HEATER FOR REFRIGERATOR CARS

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Application May 10, 1946, Serial No. 668,829

3 Claims. (Cl. 158—82)

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This invention relates to railroad car heaters employing liquid fuel. In particular the invention relates to an alcohol heater for use in a railroad car, such as an insulated refrigerator car, employed for shipping perishable articles such as fruits and vegetables. Particularly in the winter, it is necessary to heat such cars to prevent the goods being damaged by freezing. Such heaters must not only be rugged and sturdy so as to withstand the treatment to which they are subjected during travel, but they must be reliable in operation. It is a principal object of the invention to provide such a heater.

Certain types of fruits and vegetables will readily spoil if the temperature of the railroad car is not maintained within a very narrow temperature range. Consequently, it is an important object of the invention to provide a railroad car heater which may be accurately controlled to maintain the temperature of the car within a relatively narrow temperature range.

It is further an object of the invention to provide a heater with a fuel control mechanism including upper and lower fuel compartments, the lower fuel compartment receiving fuel from the upper fuel compartment and transmitting the same to a pilot burner in controlled amounts, with the upper fuel compartment supplying fuel in very accurately controlled amounts to the main burner of the heater.

The invention has for another object the provision of a main burner of annular shape, said burner being hollow to provide a circulating chamber and having near its lower surface a vaporizing chamber adapted to receive liquid fuel from a fuel supply, the vaporizing chamber being disposed adjacent the pilot burner to be heated thereby. In accordance with the invention the vaporizing chamber may be provided with a bimetallic control valve which operates to prevent the entrance of fuel to the vaporizing chamber until the temperature of the chamber has been raised to a sufficient degree by the pilot burner disposed adjacent thereto.

It is still a further object of the invention to provide a railroad car heater of cylindrical shape with a cylindrical chimney which is disposed within and at one side of the heater, the upper portion of the heater containing a liquid fuel tank of crescent design and which fills the upper portion of the heater with the exception of the chamney which is disposed within the space defined by the concave surface of the crescent.

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These and other objects of the invention will become more apparent from the following description and claims when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a side elevation of the complete heater partially broken away in section to show the internal construction;

Fig. 2 is a top plan view of the main body of the heater;

Fig. 3 is a sectional view of the base on the line 3—3 of Fig. 2 showing the burner and the fuel control mechanisms in elevation;

Fig. 4 is a top view of the base;

Fig. 5 is an end elevation of the heat control lever assembly;

Fig. 6 is the top plan view of the burner (enlarged);

Fig. 7 is an enlarged sectional view through the main burner and the pilot burner;

Fig. 8 is an enlarged cross sectional view of the fuel control mechanism;

Fig. 9 is an end view of the same and

Fig. 10 is a top view of the same.

The present invention like most of the charcoal and liquid fuel railroad car heaters is housed in a two-part structure comprising a cylindrical base 2 and an upper cylindrical shell 3 both advantageously constructed of sheet metal such as galvanized steel or the like.

The cylindrical base 2 is provided with two spaced annular beads 4 and 5. The groove formed by the lower bead 4 forms a retaining means for the sheet metal bottom 6, the edge of which is engaged in said groove and secured therein.

The upper bead 5, which is near the upper edge of the base 2, serves as a shoulder for the lower edge of the upper cylindrical shell 3 when the latter is placed on the base 2 in assembled position.

The cylindrical base 2 is provided with a plurality of openings 7 in its side walls for the admission of the air necessary for combustion. The cylindrical base 2 supports and encloses the burner mechanism, and the fuel control mechanism.

The main burner 8, the details of which will be later described, is supported above the bottom 6 by means of a number of bolts 9 threaded at each

end to receive pairs of nuts 10. The bolts 9 at their upper ends extend through apertures in the burner ring 11, and at their lower ends they extend through apertures in the bottom 6. In fact the whole structure, as will be noted from the drawings, is supported on the bolts 9 for they extend through the base 6. It will be noted that the arrangement provides substantial support for the burner 8 and permits some adjustment in the height of the burner.

The pilot burner 12 is also supported by means of a bolt 13 which passes through the bottom 6 and is threadedly secured in the bottom 14 of the pilot burner.

The cylindrical base 2 also houses and supports a liquid fuel control mechanism generally designated as 15, for supplying the proper amount of fuel to the main burner 8, through conduit 16, and to the pilot burner 12, through the conduit 17. The liquid fuel control mechanism 15 includes a thermostatic device 18, both mechanisms being secured together as a unit and being supported within the cylindrical base 2 by means of the bracket 19 which may be secured to the inner wall of the cylindrical base 2 by welding, brazing or the like.

The structure and operation of the main burner, pilot burner, liquid fuel control mechanism and other elements within the cylindrical base 2, constitute vital parts of the present invention. However, before describing these elements and their operation in detail it is well to describe briefly the remaining main parts of the heater.

The upper cylindrical shell 3 is circumferentially corrugated as shown so as to stiffen it. This upper cylindrical shell 3 is provided with a reinforcing band 20 having apertures for the ends of the lifting handle or bale 21 and apertured ears 22 to permit the heater to be anchored to the wall of a railroad car or the like.

The upper cylindrical shell 3, on one side (see Fig. 2) houses a cylindrical chimney 23, the lower portion of which is fitted with a frusto-conical member 24. One wall of the chimney 23 is bolted to the cylindrical shell 3 by the bolts and nuts 25 and 26 respectively.

The upper cylindrical shell 3 also contains a liquid fuel tank 27 which is crescent-shaped in section so as to extend around the chimney 23 as much as possible (see Fig. 2).

The fuel tank 27 is provided with a fill cap 28 on its upper surface to enable the tank to be filled. Fuel from the tank 27 passes through the exit conduit 29 controlled by the tap-cock 30 which is adapted to be connected to the fuel control mechanism 15.

From Fig. 2 it will be seen that the chimney 23 and the fuel tank 27 are separated by a partition 31 which at each edge is secured to the wall of the upper cylindrical shell 3 by the bolts 32 and nuts 33. The fuel tank 27 is supported by means of two brackets 34, 35, one end of each of which is secured to the wall of the heater shell 3, the other end being bolted to the partition 31 by the bolts 36 which also pass through the wall of the chimney 23. The partition 31 is held in spaced relation to the chimney 23 by means of the spacers 37 on the bolts 36, the whole being rigidly secured by the nuts 38.

The space between the fuel tank 27 and the partition 31 may be filled with insulation material 39 to protect the fuel tank 27, this insulation 39, in fact, being the only insulation necessary in the complete heater.

The side wall of the upper cylindrical shell 3 adjacent the chimney 23 is provided with a series of openings 40 and 41 to permit the heat to escape to the space to be heated.



Reference is now had to Figs. 3, 4, 6 and 7 which illustrate the main burner 8. This burner 8 is comprised of an annular hollow member the upper surface 42 of which is provided with a plurality of radial ridges 43 each having a series of burner ports 44 therein.

The main portion of the annular hollow member constitutes a circulating chamber 45 for the fuel vapors, which chamber enables the fuel to be distributed evenly to the various burner ports 44.

The lower part of the circulating chamber 45 at one point is joined to a downwardly extending hollow cylindrical member 46 the interior of which, as will be described, comprises a vaporizing chamber 47 having a side inlet 48 which is connected by the conduit 16 to the fuel control mechanism 15. The vaporizing chamber 47 contains a U-shaped bi-metallic element 49 one end of which carries a button valve member 50 adapted to block the inlet 48. Element 49 tends to straighten out when cool and bends its downwardly extending arms toward each other when heated, and functions to maintain inlet 48 closed until chamber 47 has been heated sufficiently by the pilot burner.

The main burner 8 may advantageously be constructed of a combination of cast parts and sheet metal. The upper part of the burner which is provided with the radial ridges 43 having the burner ports 44 may be of cast material. The lower part of the burner which is joined to cylindrical member 46 may also be of cast metal. The walls of the central portion comprising the circulating chamber 45 are preferably constructed of sheet metal which may be brazed, welded or otherwise joined to the top and bottom parts of the burner.

As will be appreciated from Fig. 7 the outer wall of the central portion of the burner is frusto-conical in shape. The inner wall 51 of the central portion of the burner is cylindrical and is formed with an annular groove 52 to receive the three arms 53 of the flame spreader 54 (see Figs. 6 and 7).

Disposed below the main burner 8 and concentrically with respect thereto is the pilot burner 12 which is comprised of a cylindrical shell 55 and a base member 56 (see Fig. 7) secured to the bottom 6 of the heater (Fig. 1) by means of the bolt 13 and nut 14. The cylindrical shell 55 of the pilot burner 12 is filled with a wick 59 of asbestos or similar material adapted to receive fuel from the base member 56 through the conduit 17 leading to the fuel control mechanism 15.

The fuel control mechanism 15 is shown in detail in Figs. 8 and 9 as being comprised of a casing 60 of generally rectangular shape and divided intermediate its top and bottom by a horizontal partition 61 to form an upper fuel compartment 62 for supplying fuel to the main burner 8 and a lower fuel compartment 63 for supplying fuel to the pilot burner 12.

The upper fuel compartment 62 is adapted to receive fuel from the fuel tank 27 of the heater through a conduit 64 which connects with an inlet nipple 65 of a valve device 66, secured to the top of the casing 60. As shown in Fig. 8, the valve device 66 may, advantageously, be formed integrally with the top wall of the casing 60.

The valve device 66 includes a chamber 67 in

which is disposed a stem 68, the lower portion of the stem being mounted in the top of the casing 60. The stem 68 is provided with a central bore 69 which communicates with the chamber 67 through the small openings 70 and 71. The upper portion of the bore 69 is closed by the screw 72 which aids in securing the stem 68 in place. Intermediate its length, the bore 69 is provided with a construction 73 and below the constriction the bore 69 loosely encloses a valve member 74 which valve member when in raised position is adapted to close the constriction 73 and thus prevent fuel from passing through the valve to the upper fuel compartment 62.

The upper fuel compartment 62 contains a float 75 mounted on an arm 76 pivoted to a bracket 77 secured to the inner walls of the upper fuel compartment. The arm 76 is provided with a spring member 78 which engages the lower end of the valve member 74.

It should now be evident that as the upper fuel compartment 62 is filled with fuel, the float 75 will rise and finally the spring member 78 will cause the valve member 74 to close the constriction 73 thus shutting off the supply of fuel to the upper fuel compartment.

The fuel control mechanism 15 includes a needle valve device 79 which is mounted in an extension of the casing 60. This needle valve device 79 is illustrated to advantage in Figs. 8 and 9, as comprising a casing portion 80 which may be integral with the main casing 60 and which is provided with a vertical bore 81 terminating in a fuel chamber 82 the lower end of which is connected by means of an elbow joint 83 with the conduit 16 leading to the inlet of the main burner 8.

A valve stem 84 is vertically slideable in the bore 81 which valve stem terminates in a valve head 85 which in its lower position is adapted to close the fuel outlet of the valve device 79. A spring 86 surrounding the stem 84 bears at one end against the valve head 85 and at its other against the upper wall of the chamber 82 so as to urge the valve head 85 downwardly into closed position. The chamber 82 is adapted to receive fuel from the upper fuel compartment 62 through a small opening 87.

The upper end of the valve stem 84 terminates in a button head 88. Mounted on the casing 60 to stand upwardly therefrom is a bracket 89, on which is pivotally mounted as at 90 a fulcrum lever 91. From Fig. 5 it will be observed that the lever 91 is of U-shaped cross-section. The short end of the lever 91 is provided with a slot for engaging the stem 84 beneath the button head 88. The long end of the lever 91 is connected to the stem 92 of the thermostat device 18 The thermostat device may be of the conventional variety operated for example by a bellows element 112 so as to raise the stem 92 and the long arm of the lever 91 gradually as the temperature increases. Such action, as will be apparent, results in the valve head 85 closing the valve, thus shutting off the supply of fuel to the main burner 8.

When the space adapted to be heated by the heater becomes cool, the bellows element of the thermostat 18 moves in the other direction to pull down the long arm of the lever 91 causing the short arm to rise, thus moving the valve stem 84 upwardly and opening the valve so as to cause the flow of fuel from the upper fuel compartment 62 to the main burner 8. The amount of upward movement of the valve stem 84 may be



controlled and regulated by means of a regulating screw 93 in a laterally extending arm 94 of the bracket 89. The regulating screw 93 may be locked in any position by means of the lock nut 95.

Referring now to the thermostat 18 and with reference to Figs. 3, 5 and 8, the thermostat has been shown as of the bellows type having a bellows element 112 and a stem 92 adapted to be raised and lowered by the bellows element 112 to actuate the arm 91.

In the thermostat shown the adjustment for the various temperature settings is accomplished by changing the length of the link 92 between the lever 91 and the bellows element 112. This is done by moving the cam 98 to the setting desired by means of a handle 96 secured on a rotatable stub shaft 97 on which the cam member 98 is secured. The handle 96 is provided with a spring pressed knob 99 adapted to be engaged in any one of a series of depressions 100 in a plate 101. Each of the depressions 100 indicates a particular temperature. When cam 98 is moved the lever 91 is kept in constant contact with the cam member 98 by means of a leaf spring 113, thus causing the effective length of the link to become longer or shorter as the cam member 98 is moved on one direction or the other.

The stem 92 of the thermostat 18 is made up of two parts 92*a* and 92*b* to allow for calibration of the instrument. This is done by turning part 92*b* within part 92*a* by means of a screw driver in the slot 92*c*. This causes part 92*b* to run on thread 92*d* thus adjusting the length of the link 92 to some predetermined temperature. After this has been done the lock nut 92*e* is set.

The lower fuel compartment 63 within the casing 60 is connected with the upper fuel compartment 62 by means of an opening 102 in the partition 61. The opening 102 is surrounded by downwardly projecting cylindrical member 103 provided with interior threads adapted to receive the valve device 104. The valve device 104 has a central bore 105 the lower portion of which is enlarged to receive loosely a valve member 106. The lower end of the valve member 106 is engaged by a spring member 107 mounted on the float 108. The float 108, similarly to the float in the upper fuel compartment, is mounted on an arm 109 pivotally secured to the bracket 110 carried by an inner wall of the lower fuel compartment. The lower fuel compartment is provided with an outlet opening 111 near its lower surface, said outlet being connected by the conduit 17 to the pilot burner 12 so as to supply fuel to the pilot burner.

It should now be obvious that the lower fuel compartment 63 is adapted to be filled with fuel from the upper fuel compartment 62 through the opening 102 in the partition 61 and through the valve device 104. As the fuel supply in the lower fuel compartment 63 rises, the float 108 will rise and eventually the spring member 107 will cause the valve member 106 to close the bore 105 in the valve device thus shutting off the supply of fuel from the upper fuel compartment to the lower fuel compartment.

It will be noted that the casing 60 thus contains two fuel compartments, the upper fuel compartment 62 being adapted to supply fuel to the main burner 8 and also through the float-controlled valve device 104 to supply fuel to the lower fuel compartment 63, which in turn supplies the fuel for the pilot burner 12.

It will be noted that the fuel supply to the

main burner from the upper fuel compartment is carefully controlled and regulated by means of a needle valve stem 84 which in turn is controlled by the thermostat 18.

Assuming that the pilot burner has been lighted, and the railroad car is cold enough to require heat, the thermostat 18 will actuate the needle valve stem 84, thus causing a supply of fuel to pass from the upper fuel compartment 62 through the conduit 16 to the vaporizing chamber 47 of the main burner 8.

It will be noted that this vaporizing chamber 47 is closely adjacent to the pilot burner 12 so as to be heated thereby, thus vaporizing the fuel which rises into the annular circulating chamber 45 and then, in a vaporized condition, to the burner ports 44. The flame from the pilot burner is spread by the flame spreader 54 so as to hug the inner wall 51 of the burner, thus additionally heating the vapors within the circulating chamber 45 and also thus assuring combustion of the vapors at the burner ports 44. The pilot burner 12 thus serves the dual purpose of acting as a means of vaporizing the fuel for the main burner 8 as well as igniting the vapors emerging from the orifices or ports 44 of the main burner.

It will be apparent that the invention provides a main burner having a vaporizing chamber with means for supplying fuel to the vaporizing chamber in amounts not to exceed the capacity of the chamber. This control means is, of course, the float valve and the needle valve operated by the thermostat for controlling the supply of fuel from the upper fuel compartment to the vaporizing chamber.

The pilot burner 12, as indicated, also serves the purpose of continuously heating the vaporizing chamber and through means of the flame spreader, heating the main burner so as to maintain it at a temperature necessary to prevent condensation of the vaporized fuel. A continuous supply of fuel to the pilot burner flame, sufficient to maintain the desired heat, is controlled by the float valve in the lower fuel compartment.

It now will also be appreciated that the bi-metallic U-shaped element 49 in the vaporizing chamber 47 constitutes a safety device the purpose of which is to prevent fuel from entering the vaporizing chamber until the proper temperature has been reached. Since the vaporizing chamber is adjacent the pilot burner, it is apparent that the bi-metallic element 49 will remain in the closed position of Fig. 7 and will not bend and move button 50 away from inlet 48 to permit the flow of fuel into the vaporizing chamber until the vaporizing chamber has been sufficiently heated by the pilot burner.

Little has been said herein regarding the type of fuel to be used. While any liquid fuel which is easily vaporized may be employed, the heater is especially designed to employ alcohol or the like which can be obtained in sufficient quantities conveniently even in small towns.

The device is simple in construction, sufficiently rugged to withstand the effects of travel, and also sufficiently accurate to control the temperature of a railroad car within a narrowly defined temperature range.

While it is obvious that changes in the structure and design may be made within the teachings of the invention, it should also be apparent that the invention is not to be limited in scope except as indicated by the language of the following claims.

We claim:



1. In a heater, a main burner comprising an annular hollow main burner element having a series of burner ports in its upper surface, said burner having wall means defining an inner annular space of said burner element which functions as a vapor circulating chamber, wall means forming a vaporizing chamber connecting with the lower portion of said circulating chamber, means for supplying said vaporizing chamber with a liquid vaporizable fuel, and a pilot burner disposed beneath said annular element and adjacent said vaporizing chamber to heat the same to vaporize liquid fuel therein, said pilot burner being also disposed so that flame therefrom passes upwardly through the central opening formed by said annular burner element to ignite the vapor emerging from said series of burner ports, means for supplying liquid fuel to said pilot burner, and thermostatic valve means disposed in said vaporizing chamber to cut off the fuel supply to the vaporizing chamber until the same has been heated by the pilot burner to a predetermined temperature.

2. In a heater, a main burner having walls forming a hollow chamber, the uppermost of said walls having a series of burner ports in communication with the interior of the chamber, additional wall means forming a separate vaporizing chamber, conduit means connecting the vaporizing chamber with the hollow chamber of the main burner, means for supplying liquid vaporizable fuel to said vaporizing chamber, a continuously burning pilot burner disposed adjacent both said vaporizing chamber and said main burner ports for vaporizing liquid fuel in said vaporizing chamber, and for igniting vapor emerging from said main burner ports, the walls forming said main burner chamber being elongated and circular to give said main burner chamber a greater top to bottom height than width, and being rounded to form said main burner and chamber as an annulus having a central opening extending therethrough, said vaporizing chamber being disposed below a portion of said annulus, said conduit means connecting with the lower part of said main burner chamber to permit the extensive height of said chamber to assist in the even distribution of vapors to said burner ports, said pilot burner being disposed centrally below the opening in said annulus alongside said vaporizing chamber.

3. In a heater, a main burner having walls forming a hollow chamber, the uppermost of said walls having a series of burner ports in communication with the interior of the chamber, additional wall means forming a separate vaporizing chamber, conduit means connecting the vaporizing chamber with the hollow chamber of the main burner, means for supplying liquid vaporizable fuel to said vaporizing chamber, a continuously burning pilot burner disposed adjacent both said vaporizing chamber and said main burner ports for vaporizing liquid fuel in said vaporizing chamber, and for igniting vapor emerging from said main burner ports, the walls forming said main burner chamber comprising a hollow cylindrical inner wall, a frusto-conical outer wall, an annular top wall having a width substantially less than the height of said inner and outer walls, and a bottom wall joining said inner and outer walls, the main burner chamber thus defined having a greater height than width to facilitate even distribution of vapors to said burner ports, said vaporizing chamber being disposed below a portion of said bottom wall, said conduit means con-

necting with the lower part of said main burner chamber, said pilot burner being disposed centrally below and in axial alignment with said hollow inner wall and alongside said vaporizing chamber, and a flame spreading element located inside and attached to said hollow inner wall in line with said pilot burner.

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## REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 243,495 | Brainard | June 28, 1881 |
| 255,245 | Brainard | Mar. 21, 1882 |
| 714,722 | Macleod | Dec. 2, 1902 |
| 915,692 | Norstrom | Mar. 16, 1909 |
| 1,320,325 | Elster | Oct. 28, 1919 |
| 1,466,797 | Lamb | Sept. 4, 1923 |
| 1,735,475 | Sladky et al. | Nov. 12, 1929 |
| 1,779,572 | Valjean | Oct. 28, 1930 |
| 2,017,238 | Finley | Oct. 15, 1935 |
| 2,024,510 | Crisenberry | Dec. 17, 1935 |
| 2,025,837 | Tullis | Dec. 31, 1935 |
| 2,055,995 | Bradbury | Sept. 29, 1936 |
| 2,188,212 | Wernli | Jan. 23, 1940 |
| 2,346,817 | Breese et al. | Apr. 18, 1944 |
| 2,404,853 | Landon | July 30, 1946 |

FOREIGN PATENTS

| Number | Country | Date |
|---|---|---|
| 91,395 | Germany | Apr. 12, 1897 |
| 527,194 | Germany | June 15, 1931 |
| 728,041 | France | Apr. 5, 1932 |