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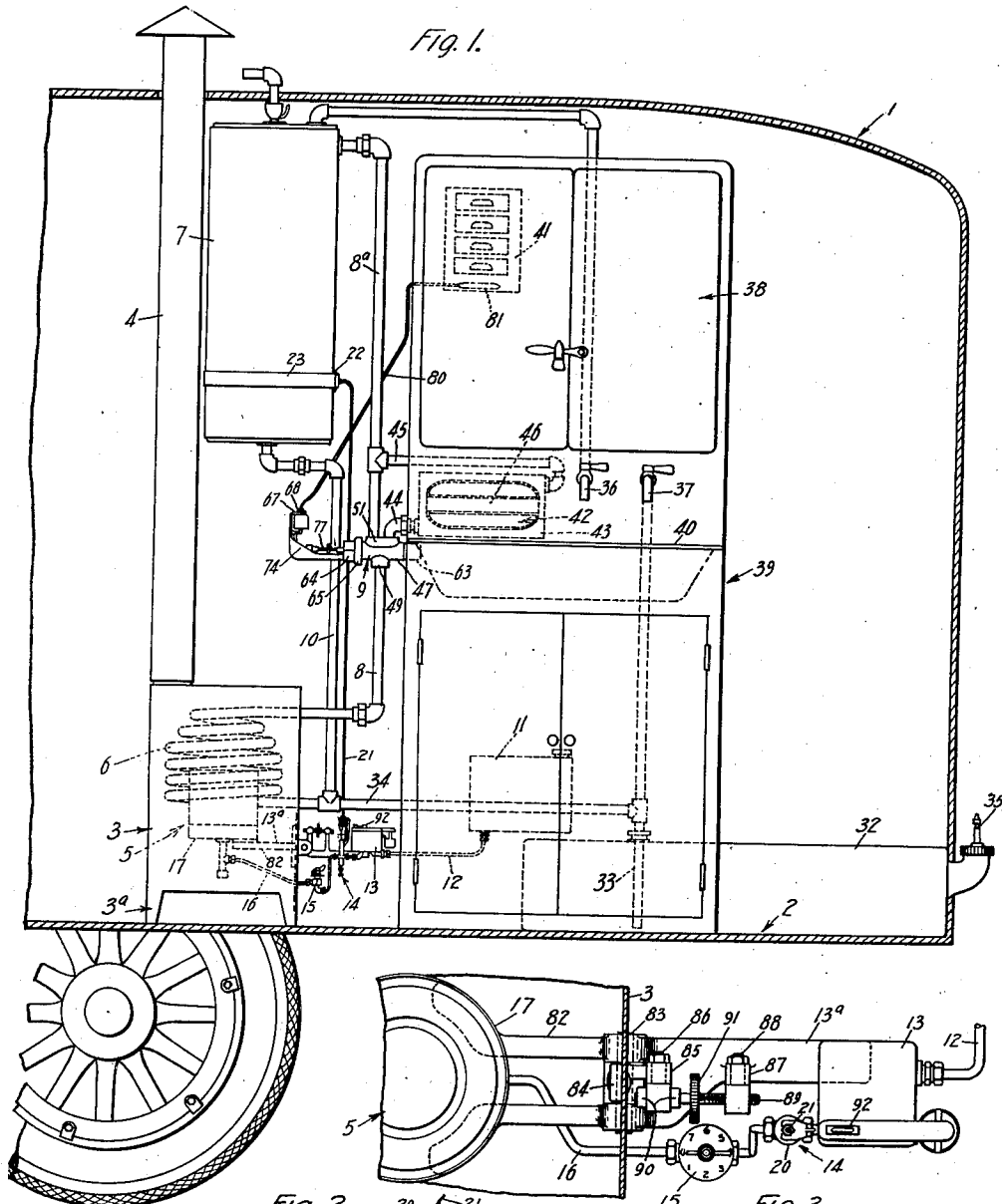
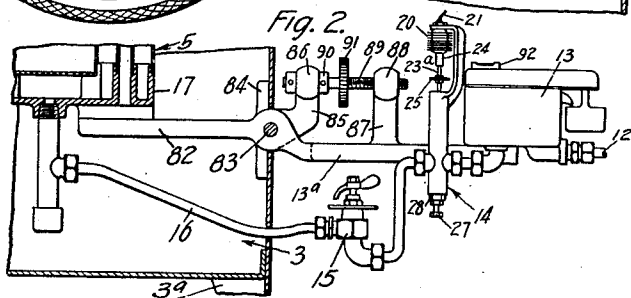
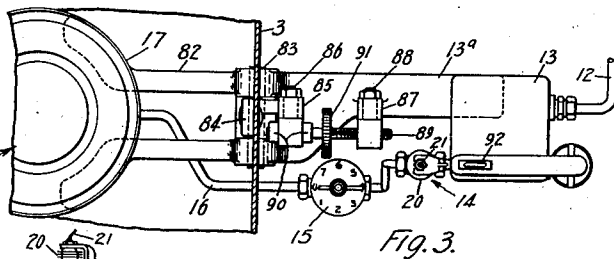
L. O. SELBY

2,241,328

REFRIGERATING SYSTEM

Filed Oct. 21, 1936

2 Sheets-Sheet 1



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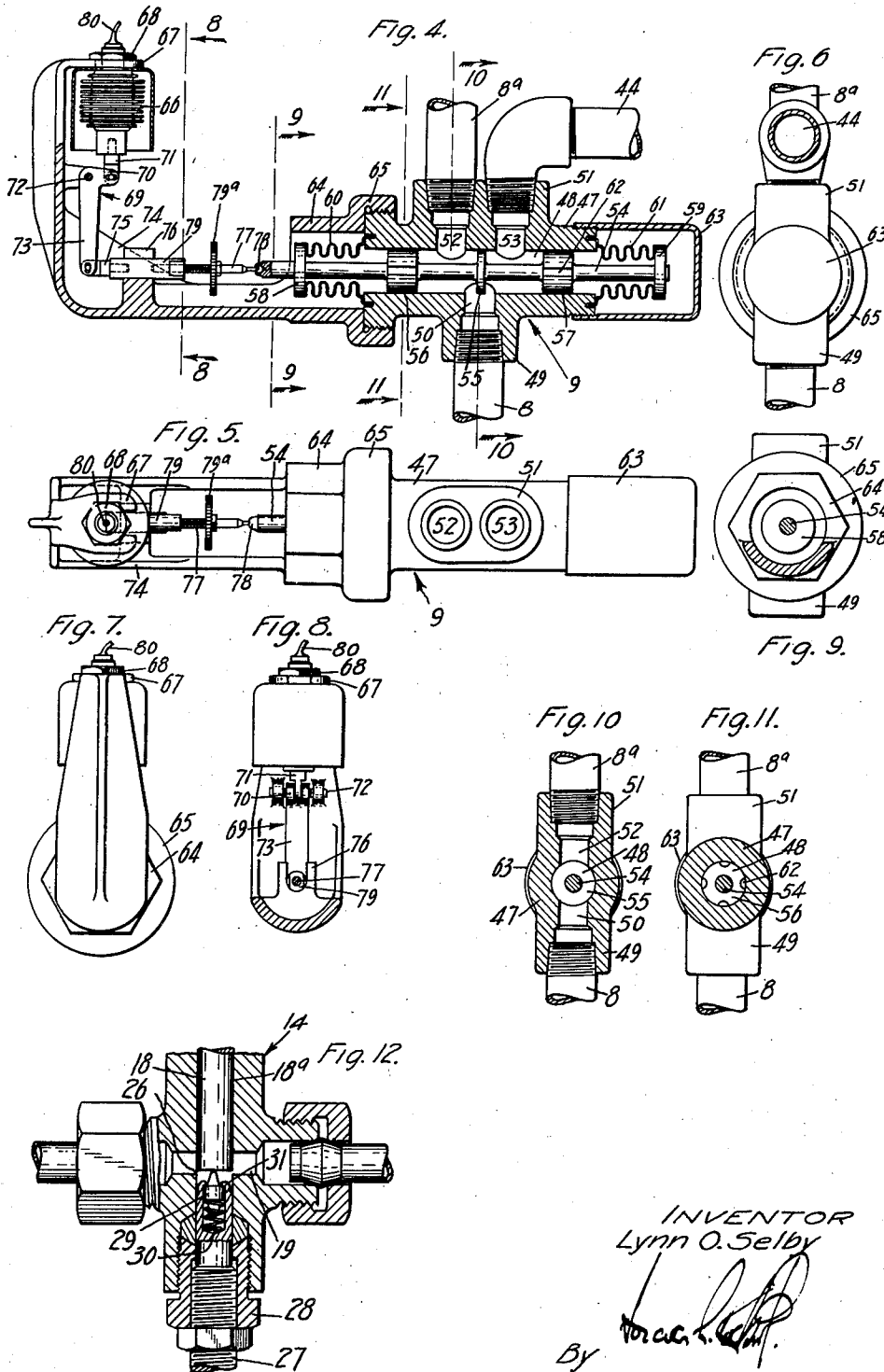
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2 Sheets-Sheet 2



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REFRIGERATING SYSTEM

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Application October 21, 1936, Serial No. 106,833

7 Claims. (Cl. 62—5)

My invention relates to refrigerating systems.

It has among its objects to provide an improved refrigerating system of the absorption type utilizing a heated fluid as the heating medium for the circulating refrigerant. A further object is to provide an improved system having heating and refrigerating means which are wholly automatic in operation; and more particularly, to provide such a system wherein an automatic temperature controlled heating system also furnishes the heat for operating an absorption type refrigerator. Another object of my invention is to provide such a heating and refrigerating system in which the heat for circulating the refrigerant is obtained from the heated medium in an improved manner. A further object is to provide automatic means for controlling the circulation of heating medium whereby to control the heat supplied to the refrigerator. Further objects of my invention are to provide an improved automatically controlled combined hot water heating and refrigerating system and such a system utilizing a thermostatically governed distillate type oil burner. A still further object is to provide such a combined oil burning hot water and refrigerating system, which while not limited thereto, is especially adapted for installation in trailers, small boats and the like, where available space is very limited. Other objects are to provide improved thermostatically controlled valve means for governing the flow of hot water to the refrigerator and the hot water storage tank under varying temperature conditions in both; improved burner mounting and levelling means; and in general, a compact and efficient installation for combined water heating and refrigeration which is reliable and safe in operation. These and other objects and advantages of my construction will, however, hereinafter more fully appear.

In the accompanying drawings I have shown for purposes of illustration one embodiment which my invention may assume in practice.

In these drawings—

Figure 1 is a side elevation partly in section of an automobile trailer having therein a combined oil burning hot water and refrigerating system embodying my invention;

Fig. 2 is an enlarged side elevation of the thermostatically controlled oil burner of Figure 1 with parts of the burner and stove sectioned to show the burner support;

Fig. 3 is a plan view of Figure 2;

Fig. 4 is a sectional elevation of a thermo-

statically controlled valve for governing the circulation of heated water;

Fig. 5 is a top plan view of the valve of Figure 4;

Fig. 6 is an end view as viewed from the right in Figure 4;

Fig. 7 is an end view as viewed from the left in Figure 4;

Fig. 8 is a section on line 8—8 of Figure 4;

Fig. 9 is a section on line 9—9 of Figure 4;

Fig. 10 is a section on line 10—10 of Figure 4;

Fig. 11 is a section on line 11—11 of Figure 4, and

Fig. 12 is an enlarged sectional detail of the thermostatic valve of Figure 2 in the vicinity of the control plunger of the valve.

In Figure 1 I have for purposes of illustration shown my invention as embodied in a combined oil burning hot water and refrigerating system installed in an automobile trailer, in connection with which it has particular advantages, although it will be understood that my invention is not in any way limited to use in trailers.

Referring to this figure, the trailer 1 has a floor 2 on which is supported, adjacent a side wall of the trailer, a stove 3 having a flue 4 which extends through the roof of the trailer. As herein shown, a distillate type oil burner 5 constitutes the heating means therein and may be used for heating the trailer and for cooking purposes in a usual manner. The stove 3 is also provided with a water heating coil or stack 6 for heating the water in a storage tank 7. The upper end of coil 6 is connected through riser pipes 8, 8a and an intermediate thermostatically controlled valve 9, hereinafter more fully described, to the upper end of the storage tank 7, and its lower end is connected through a pipe 10 to the bottom of the tank to provide for the usual circulation of the water by convection when the burner heats the water in coil 6.

The hot water heating means includes a thermostatically actuated valve generally of the construction described and claimed in my copending application, Serial No. 759,196, filed December 26, 1934. Oil is supplied to the burner 5 from an oil supply tank 11 through a feed pipe 12, which communicates with a constant level float chamber 13 supported on an improved pivoted leveling bracket 13a, hereinafter described, and through a thermostatically controlled valve 14 and metering valve 15 which are connected in the feed line 16 between the float chamber 13 and the burner base 17. The valve 14, as shown most clearly in Figure 12, has a plunger

18 reciprocable in a vertical plunger passage 18a which controls the supply passage 19, thereby controlling the amount of oil which is fed from the float chamber 13 (Fig. 2) through the feed pipe 16 to the burner. This plunger is reciprocated by a bellows 20 which is in communication through a capillary tube 21 (Fig. 1) with a contact button 22 which is held in intimate contact with the water storage tank 7 by means of an attaching band 23. It will be understood that the contact button 22, tube 21 and bellows 20 contain a suitable temperature responsive expansible fluid and that changes in temperature in the water in storage tank 7 cause the fluid in contact button 22 to expand and contract, thus causing the bellows 20 to expand and contract and reciprocate the plunger 18. The plunger 18 is connected to the bellows by means of a connecting rod 23a (Fig. 2) which has a ball and socket connection with the plunger at one end and is screw threaded at its other end into a boss 24 on the lower end of the bellows, thus providing means for adjusting the position of the plunger relative to the bellows by rotating a knurled wheel 25 fixed on the connecting rod 23a.

As in my prior application, means are also provided for normally limiting the downward movement of the plunger across supply passage 19, so as to maintain normally at least a minimum pilot orifice 26 in the passage. As shown in Figure 12, a stud 27 is screw threaded into a packing gland 28 which in turn is screw threaded into the lower end of the plunger passage 18a. The stud 27 is recessed at its upper end and has a pointed abutment member 29 located in its recessed end and biased upwardly by a spring 30 against a turned-over shoulder 31. The stud 27 is so adjusted that when the plunger 18 has cut off the supply passage 19 to provide the minimum pilot orifice 26, the pointed end of abutment member 29 engages the plunger 19 and prevents complete cut-off of the supply passage under normal temperature conditions in the storage tank 7.

Water is supplied to the system from a tank 32 (Fig. 1) through a riser 33 and supply line 34. The tank 32 has an air valve 35 in its filler cap by which compressed air may be introduced into the tank for maintaining a sufficient air pressure over the water in the tank to force the water in the tank upwardly into the system whenever water is drawn from the hot water faucet 36 or the cold water faucet 37. The tank 32 may be, and frequently is, installed below the floor 2 of the trailer.

In accordance with this invention, means are provided for utilizing the heat in the water rising in the pipe 8 from the stack 6 to heat and circulate the refrigerant in a refrigerator 38 of the absorption type which, as shown herein, is installed in the upper part of a cabinet 39 above the sink 40. The refrigerator 38 includes the freezing unit 41 and the usual boiler 42 containing the refrigerant to be heated, these elements being connected in a usual circulating system (not shown) including the usual piping, condenser means, etc. The boiler 42 is enclosed in a jacket 43 which is connected by a pipe 44 with the valve 9, previously mentioned, and by another pipe 45 which is connected to the riser 8a leading from the valve 9 to the top of the storage tank 7. Preferably the pipe 44 is connected at the bottom of the jacket 43 while the pipe 45 is connected at the top of the jacket at the opposite end thereof so that the hot water entering the jacket 43 is

caused to come in contact with the entire surface of the boiler. It will be noted that the jacket 43 constitutes a part of a shunt circuit for the heated water rising from the stack 6 and that this heated water, as determined by the position of the valve 9, will pass either directly to the storage tank 7 or through the shunt path including the jacket 43. It will also be noted that the heated water passing through the jacket 43 circulates around the boiler 42 as well as through the hollow core 46 therein. The boiler 42 is preferably formed of some good heat conducting material, such as copper, and may be formed with suitable fins, or corrugations, to increase the heat transfer to the refrigerant in the boiler 42 from the water flowing through the jacket 43.

In Figures 4-11 I have shown an improved thermostatic valve for controlling the flow of rising hot water in pipe 8 in accordance with the temperature conditions prevailing in the refrigerator 38. Referring particularly to Figure 4, the valve 9 comprises a generally cylindrical body portion 47 having a cylindrical axial control passage 48 which is open at its opposite ends. The body portion 47 is provided on its under side with a boss 49 into which the riser pipe 8 is screw threaded and which has an inlet passage 50 communicating with the axial control passage 48. A similar but larger boss 51 is provided on the upper side of body 47, having outlet passages 52 and 53 therein which are located on opposite sides of the inlet passage 50, as is shown most clearly in Figure 4. The passages 52 and 53 are in communication, respectively, with pipes 8a and 44, both of which are suitably screw threaded into boss 51.

A valve stem 54, (Fig. 4), which is reciprocable in the control passage 48, is formed with an intermediate annular valve member 55 which has a close running fit in the passage 48 and is movable across the inlet passage 50 between two extreme positions as the plunger is reciprocated to establish communication alternately between the inlet passage 50 and the two outlet passages 52 and 53. The valve stem 54 also has enlarged cylindrical portions 56 and 57 on opposite sides of the valve member 55 which constitute guiding means for the valve stem as the latter is reciprocated in the passage 48. Control passage 48 is provided with fluid tight closures at its opposite ends. For this purpose, the valve stem 55 is provided with integral annular discs 58 and 59 adjacent its opposite ends which are united in a fluid tight manner to the opposite ends of the valve body 47 by means of longitudinally flexible bellows 60 and 61. The guiding portions 56 and 57 are provided with longitudinal surface grooves 62, thereby establishing free fluid communication throughout the control passage on both sides of the movable valve member 55. The bellows 61 is enclosed in a protective housing 63 which is screw threaded onto the right hand end of the valve body 47. The bellows 60 at the opposite end of the valve body is similarly protected by an annular housing 64 forming a part of an L-shaped thermostat supporting bracket which is screw threaded onto the left hand end of the valve body 47 by means of an enlarged internally threaded flange 65.

The valve stem 54 is reciprocated by means of a vertically expansible bellows 66 which is clamped at its upper end wall to the horizontal plate 67 at the free end of the L-shaped bracket by means of a nut 68. The vertical movement of the bellows 66 is conveyed to the valve stem by means of a bell crank 69, the short arm 70 of which is pivotally connected by a pin and slot

connection to a clevis pin 71. The bell crank 69 is pivoted at 72 on the frame and has its long arm 73 depending between the stiffening web 74 of the frame in position to have a pin and slot connection to a clevis 75 carried by a connecting block 79 which is slidably supported in a U-shaped boss 76 upstanding from the bottom of the L-shaped bracket. A connecting rod 77 having a ball and socket connection 78 with the valve stem 54 is adjustably screw threaded into the block 79, a knurled wheel 79a being fixed to the connecting rod to facilitate adjustment of the valve stem relative to bellows 66.

The interior of the bellows 66 is in fluid communication through a capillary tube 80 with a temperature responsive element 81 (Fig. 1) located in the freezing compartment 41 of the refrigerator. The element 81, tube 80 and bellows 66 contain a suitable expansible fluid which acts upon the bellows 66 to expand and contract the same in response to temperature changes in the refrigerator compartment.

As shown most clearly in Figures 1, 2 and 3, the burner 5 and float chamber 13 are mounted in an improved manner to enable quick leveling. Herein, the stove 3 has legs 3a by which it is permanently secured to the floor 2. The bracket 13a which supports the constant level float chamber 13 at its right hand end, as viewed in Figure 2, has a bifurcated portion 82 which extends into the stove 3 and supports at its extremity the burner base 17. The bracket 13a is journaled intermediate its ends on a pin 83 which is journaled in a bracket 84 carried by the side wall of stove 3 and located between the furcations 82. The bracket 84 is further provided with an upstanding boss 85 having a transverse passage therein to receive a bolt 86. A similar upstanding boss 87 is provided on bracket 13a having a transverse passage for a like bolt 88. The bolts 86 and 88 are provided with special heads having aligned apertures to receive an adjusting member 89 which is screw threaded into the head of bolt 88 and is journaled in the head of bolt 86, and is held against displacement in the head of bolt 86 by means of collars 90 suitably pinned thereto. The member 89 is provided with an integral knurled wheel 91 for rotating the same to adjust the level of the bracket 13a, the bolts 86 and 88 being sufficiently free in the bosses 85 and 87 to permit the necessary pivotal movement during this leveling adjustment of the bracket 13a. It will be noted that by means of the adjusting member 89, the float chamber and the burner can be simultaneously leveled about the axis of pin 83 by reference to bubble level 92.

In operation, which in practice occurs when the trailer is stationary, after the burner 5 and float chamber 13 have been leveled and the burner has been lighted, the stove will be immediately available for cooking purposes and at the same time will heat the water in storage tank 7 and cool the refrigerator 38. Assuming that the burner has thus been initially placed in operation, the fluid in the temperature responsive element 81 in the refrigerator will be expanded, thus causing the bellows 66 to be expanded and the valve member 55 to be in its extreme left hand position, as viewed in Figure 4, in which it is disposed entirely at the left of inlet passage 50. In this position of the valve 9 the hot water rising in the pipe 8 will pass through the inlet passage 50 and the outlet passage 53 to the shunt circuit including pipe 44, jacket 43, pipe 45, to the riser 8a; and heat will be abstracted from this water

by the refrigerant in the boiler 42, causing the refrigerant to circulate in the usual manner to cool the refrigerating chamber. As the temperature in the refrigerator approaches the normal low temperature, the contraction of the fluid in element 81 and the consequent contraction of the bellows 66 will cause the valve member 55 to be moved to the right as viewed in Figure 4, thus diverting part of the stream of hot water rising in pipe 8 into the outlet passage 52 leading through riser 8a directly to the tank 7. The movable valve member 55 will normally assume a position in which only sufficient hot water is passing through the outlet passage 53 to maintain the refrigerator at its normal low temperature. It will be evident that this position will vary in accordance with the room temperature, the frequency with which the doors of the refrigerator are opened and also the intensity of the flame in the burner as determined by the temperature of the water in tank 7.

Here it will be evident that when the hot water in tank 7 reaches the level of contact button 22, the expansible fluid in the latter will cause the bellows 20 to depress the plunger 18, ultimately leaving only a pilot flame in the burner, or such a small flame as is required to take care of the heat loss in storage tank 7 and to provide the required refrigeration. During the operation of the burner on a low flame or pilot flame, much of the hot water generated in the stack 6 will be diverted by valve 9 into the shunt circuit, including boiler 42 to maintain the refrigerator at its normal low temperature. It should be noted here, however, that since much of the heat is abstracted from the water while it is in contact with the boiler 42, the tank 7 will not become overheated even if water is not drawn therefrom during long periods of time. Under these conditions, if water is drawn from the hot water faucet 36 to cause the burner to burn again at a high flame, the valve 9 will automatically prevent excessively low temperatures in the refrigerator by diverting all or most of the heated water rising in pipe 8 directly to outlet passage 52 and thence to tank 7.

It will be evident that as a result of my invention, it is possible to provide an automatic hot water heating and refrigeration system utilizing a single heating source; and further to provide efficient and reliable automatic control of both without conflict between the water heating and refrigerating operations. It should also be noted that I have provided an improved thermostatically controlled valve construction for governing the circulating water which is responsive to all the variable conditions of operation, thus, for example, being capable of diverting the proper amount of water to the boiler of the refrigerator under any given temperature condition in the refrigerator regardless of whether the burner is operating on a pilot flame or on full flame. It will be further noted that the valve 9 is capable of operating regardless of the pressure of air remaining in the reservoir 32, since the valve stem is acted upon by balanced pressures at all times. Also I have provided improved burner supporting and leveling means capable of leveling the burner and float chamber quickly and easily by means of a single adjusting member. It will also be evident that I have in the construction herein disclosed provided an extremely compact arrangement of hot water storage and refrigerating system especially adapted for installation in small kitchens, trailers, and the like and one which in

the case of trailers utilizes the usual stove customarily used for heating and cooking purposes therein. These and other advantages of my improved construction will, however, be apparent to those skilled in the art.

In the illustrative construction, it will further be noted that the stove and storage tank cooperate to provide heating means for heating the interior of the trailer when necessary, it being understood, of course, that when less heat is desired, the tank may be suitably jacketed. Further, it will be understood that where, on the contrary, more heat is desired, I contemplate the use of exposed coils or other radiant heating means either in addition to the tank or in the form of a hot water radiator. Moreover, it will be understood that where such heat radiating means are substituted for the storage tank, I contemplate the use of other heating mediums than hot water, such, for example, as steam or other suitable vapor adapted to produce the desired high temperature and act upon the circulating refrigerant. It will further be understood that while in the illustrative construction I have shown a stove of the oil burner type, I contemplate the use of stoves of other well known types, including, for example, a steam boiler where the system is used for heating purposes, as, for example, with a radiator as above described. Here also, of course, it will be understood that my invention is in no wise limited in its applications either to use in trailers or to use in a combined hot water and refrigerating system, the same instead being applicable to general use in connection with refrigeration irrespective of the fluid used to heat the circulating refrigerant and further to general use as a combined space heating and refrigerating system.

While I have in this application specifically described my invention in connection with automobile trailers it will be understood that this embodiment of my invention is used for illustrative purposes and that the invention may be modified and embodied in other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A heating and refrigerating system including a closed fluid circulating path and having a fluid for circulation therein when heated, a refrigerator of the absorption type having a generator and having the refrigerant therein heated by said fluid and also having means adapted to circulate the refrigerant when heated, a burner for heating said fluid having its flame controlled by the temperature of said fluid and having means for maintaining at least a predetermined minimum flame therein, and means controlled by the temperature of the refrigerator and controlling the circulation of said heated fluid for variably supplying heat to said refrigerant.

2. In combination, a hot water heating system having water circulating means and a burner for heating and circulating the water, means governed by the temperature of the heated water for controlling said burner, an absorption type refrigerator having refrigerant adapted to circulate therein when heated by said heated water throughout normal operation of said refrigerator, and means responsive to the temperature in said

refrigerator for diverting heated water for heating said refrigerant irrespective of variation in the pressure in said system, including a valve controlling the quantity of heated water diverted to said refrigerator and actuating means for said valve responsive to the temperature in said refrigerator.

3. In combination, a hot water heating system having heating means and hot water circulating means including a storage reservoir and dispensing means connected to said reservoir, and a refrigerator of the absorption type having refrigerant adapted to circulate when heated and heated by the hot water in said system throughout normal operation of said refrigerator, said hot water system having said heating means controlled by the water temperature in said reservoir and said refrigerator having means for controlling the heating of said refrigerant in accordance with the temperature of said refrigerator.

4. In combination, a hot water heating system including a reservoir and an oil burner controlled by the temperature of the water in said reservoir, an absorption type refrigerator having refrigerant adapted to circulate when heated and heated by the hot water in said system, and valve means controlled by the refrigerator temperature and varying the heating of said refrigerant by said hot water.

5. In combination, a hot water storage system including a storage tank and means for heating and circulating the water in said tank, a refrigerator of the absorption type having a boiler adapted to contain refrigerant to be circulated, a jacket surrounding said boiler, and fluid connections including a thermostatically controlled valve means responsive to the temperature in said refrigerator for variably directing the hot water from said heating means to said jacket and storage tank.

6. In combination, a hot water storage system having a storage tank and means for heating the water in said tank including heating means and fluid outlet and inlet connections, a refrigerator of the absorption type having a boiler adapted to contain refrigerant to be circulated, a jacket surrounding said boiler having fluid connections thereto, and a thermostatically controlled valve having an inlet passage communicating with the fluid outlet connection of said heating means, two outlet passages, one communicating with said jacket and the other with said storage tank, and a movable valve stem having means for variably deflecting the heated water entering said inlet passage to said jacket and tank in accordance with temperature conditions prevailing in said refrigerator.

7. In combination, a hot water storage system including a storage tank and means for heating and circulating the water in said tank, a refrigerator of the absorption type having a boiler adapted to contain refrigerant to be circulated, a jacket surrounding said boiler, a thermostatically controlled valve responsive to the temperature in said storage tank and controlling said heating means, and fluid connections including a thermostatically controlled valve means responsive to the temperature in said refrigerator for variably directing the hot water from said heating means to said jacket and storage tank.

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