Oct. 7, 1969 H. R. KARLEN 3,470,897

LIQUID HEATER

Filed Dec. 2, 1966 2 Sheets-Sheet 1

Fig. 1

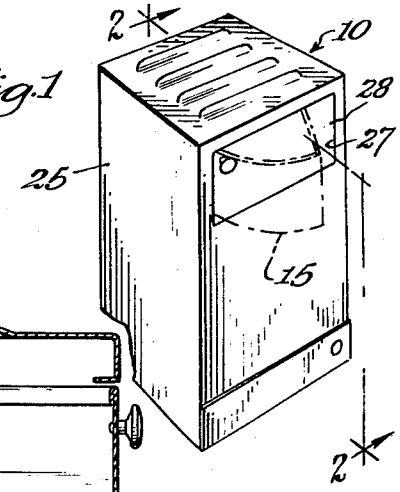
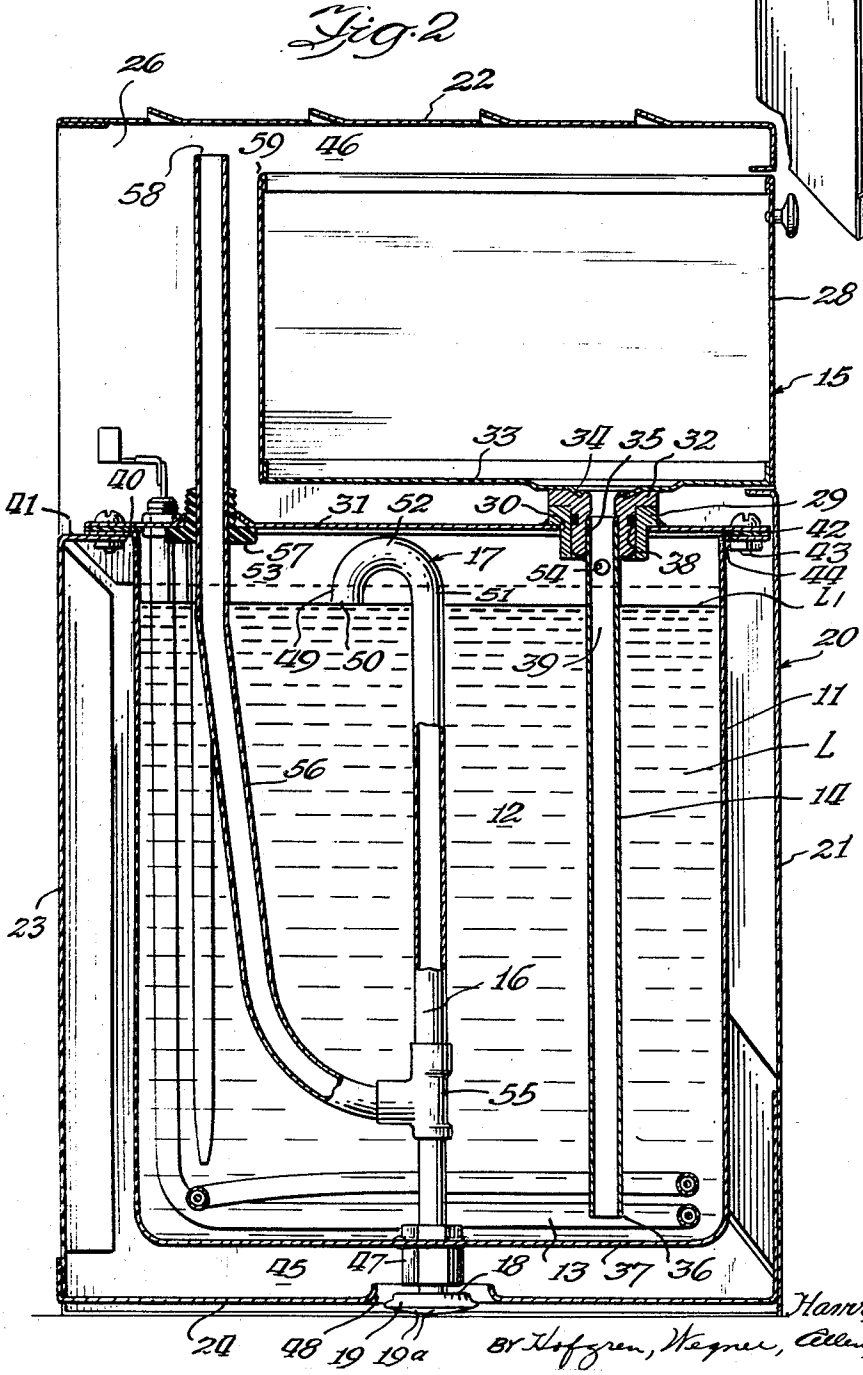


Fig. 2



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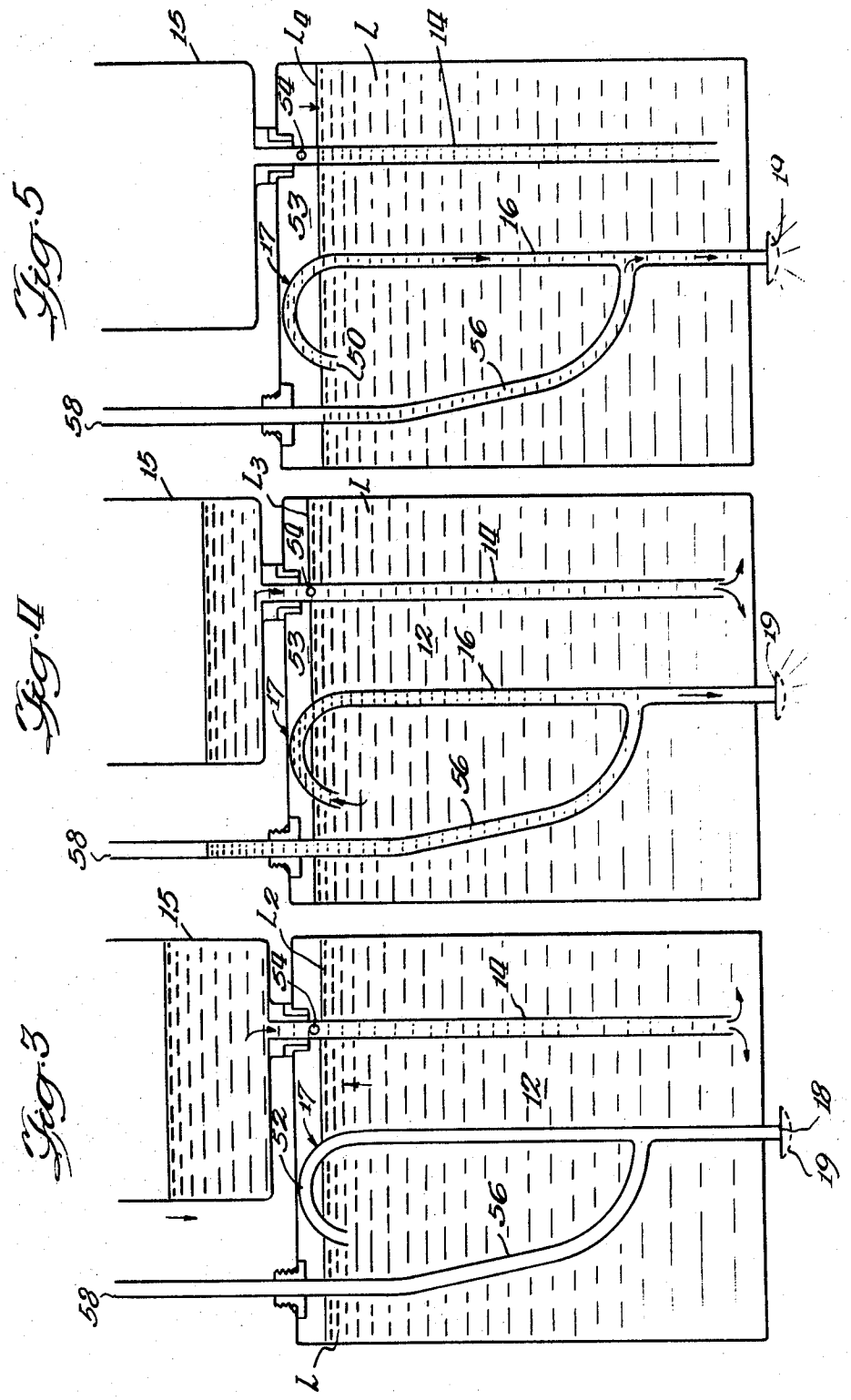

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LIQUID HEATER

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ABSTRACT OF THE DISCLOSURE

This disclosure is directed to a pass-through liquid heater having means for venting the tank through the inlet tube and means for venting the outlet duct for improved pour-through delivery of hot water from the tank as an incident of pouring of cold water thereinto. The means for supplying the cold water into the tank comprises a pivotally mounted receptacle selectively disposed in a retracted position within the housing of the apparatus and at least partially outwardly thereof for receiving the cold liquid.

This invention relates to liquid heaters and in particular to pass-through heaters wherein cold liquid is delivered into a tank to displace previously heated liquid therein for delivery of heated liquid from the tank substantially concurrently with the delivery of the cold liquid thereinto. More specifically, the present invention relates to the venting of such a liquid heater and to the means for conducting the supply liquid into the tank.

In one conventional form of liquid heater, cold liquid is heated in a tank. Inlet and outlet means are associated with the tank whereby hot liquid is conducted from the tank as the result of the delivery of additional cold liquid into the tank. Such a liquid heater is conventionally referred to as a pass-through liquid heater. In one form of such pass-through liquid heaters, the means for introducing the cold liquid into the tank comprises a receptacle above the upper level of the tank and means for conducting liquid from the receptacle to the lower portion of the tank. Thus, a preselected quantity of cold liquid may be poured into the receptacle for flow therefrom into the tank thereby to displace a corresponding quantity of hot liquid from the tank through the outlet means. This form of apparatus is commonly referred to as a pour-through brewer.

In such pour-through brewers, it is desirable to provide an expansion space in the upper portion of the tank to accommodate the increase in the volume of the liquid in the tank resulting from the heating thereof. One conventional structure employed for providing such an expansion space comprises a siphon in the outlet means. Such a siphon functions to continue the withdrawal of hot liquid from the tank until the level therein reaches the lower end of the inlet leg. The bight or upper portion of the siphon is arranged to be a preselected distance above the lower, inlet end and the level of the liquid in the tank must rise to the level of the bight before the liquid will again pass outwardly through the outlet means. In the pour-through brewers heretofore known in the art, the control of the discharge of the hot liquid from the tank has not been fully positive and some after-drip has occurred therein from time to time. The present invention comprehends an improved pour-through brewer structure utilizing an improved venting arrangement for effectively

positively precluding such after-drip and providing improved delivery of the hot liquid from the heater.

In one form of pour-through brewer heretofore employed in the art, the receptacle for receiving the cold liquid is accessible through a top opening in the cabinet structure housing the apparatus. Such structure has the serious disadvantage in certain installations of requiring substantial head room above the heater. The present invention comprehends an improved heater structure wherein the receptacle is pivotally carried for movement for accessible disposition at the front of the cabinet, thereby eliminating the need for such head room while yet permitting the receptacle to be retracted to within the cabinet when desired.

Thus, a principal object of the present invention is the provision of a new and improved pass-through liquid heater.

Another object of the invention is the provision of such a liquid heater having new and improved means for venting the upper portion of the tank for improved control of the pass-through liquid flow.

A further object of the invention is the provision of such a liquid heater having new and improved means associated with the inlet duct for venting the top of the tank.

Still another object of the invention is the provision of such a liquid heater having means for venting the discharge duct for improved control of the liquid flow therethrough.

A yet further object of the invention is the provision of such a liquid heater having new and improved means for venting the discharge duct superjacent the outlet end thereof.

Yet another object of the invention is the provision of such a liquid heater having new and improved means for conducting poured cold liquid to the tank.

Another object of the invention is the provision of such a liquid heater wherein the conducting means is selectively accessible at the front of the heater for receiving the poured liquid.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a perspective view of a liquid heater embodying the invention;

FIGURE 2 is a vertical sestion thereof taken substantially along the line 2—2 of FIGURE 1;

FIGURE 3 is a schematic vertical section similar to FIGURE 2, but illustrating the flow conditions at the time of pouring cold liquid therethrough for effecting delivery of a corresponding quantity of hot liquid therefrom;

FIGURE 4 is a schematic section similar to that of FIGURE 3, but illustrating the flow conditions at the time hot liquid is passing outwardly therefrom as the result of delivery of the cold liquid into the tank; and

FIGURE 5 is a schematic section similar to that of FIGURE 4, but illustrating the flow conditions during the siphoning action of the outlet immediately prior to the termination of a pour-through operation.

In the exemplary embodiment of the invention as disclosed in the drawing, a pass-through liquid heater generally designated **10** comprises a tank **11** defining a heating chamber **12** in the lower portion of which is disposed a conventional electrical heater **13** for heating liquid L

in chamber 12 to a desired temperature. The illustrative liquid heater 10, more specifically, comprises a pour-through heater in that cold liquid is delivered into the lower portion of the chamber 12 through an inlet conduit 14 from a receptacle 15 into which the cold liquid may be poured as from a measuring means such as a decanter or the like (not shown). The hot liquid is discharged from the tank 11 through an outlet conduit 16 provided at its inner upper end with a gooseneck siphon portion 17 and at its lower outlet end 18 with a spray head 19.

The heater 10 is housed in a cabinet 20 having a front wall 21, a top wall 22, a rear wall 23, a bottom wall 24 and side walls 25 and 26. The front wall 21 defines an opening 27 closely subjacent the top wall 22, and receptacle 15 is provided with a front wall 28 extending flush with the wall 21 across opening 27 in the retracted position of the receptacle, as shown in FIGURE 2. The receptacle is pivotally carried on an annular bushing 29 extending through an opening 30 in the cover 31 of the tank 11, by means of an annular hub 32 secured to the bottom wall 33 of the receptacle and opening upwardly through an opening 34 in the bottom wall. The upper end 35 of the inlet conduit 14 is fixedly received within the hub 32 to extend coaxially downwardly therefrom and having the lower end 36 thereof disposed slightly above the bottom wall 37 of the tank. The hub 32 may be provided with an O-ring seal 38 for providing sealed connection thereof to the bushing 29 thereby to define a sealed inlet passage 39 from the receptacle 15 to the lower portion of the tank chamber 12, while yet permitting the receptacle 15 to be swung about the vertical axis of the bushing 29 from the retracted position shown in FIGURE 2 to an accessible position shown in dotted lines in FIGURE 1 wherein a major portion of the receptacle is exposed exteriorly of the cabinet 20 for receiving cold poured liquid.

Tank 11 is provided at its upper end with an out-turned annular flange 40 resting on an inturned flange 41 of the cabinet 20. The cover 31 is secured to the flange 40 through a suitable gasket 42 by suitable securing means such as screws 43 and nuts 44, the screws 43 extending downwardly through the cabinet flange 41 to secure the tank assembly to the cabinet. The tank is so supported as to space the bottom wall 37 thereof somewhat above the bottom 24 of cabinet 20 to define a lower space 45 therebetween, and the cover 31 substantially below the top wall 22 of the cabinet 20 to define an upper space 46 therebetween.

The outlet duct 16 comprises a tube extending from gooseneck siphon portion 17 thereof downwardly through a bushing 47 extending through the bottom wall 37 of the tank and through space 45 to the spray head 19 in an opening 48 in the cabinet bottom wall 24. The gooseneck 17 defines a downturned siphon structure having a first leg 49 terminating at its lower end in an inlet 50, and a second leg 51 continuing downwardly through the duct 16. The highest point of the gooseneck siphon 17 comprises the bight 52 thereof. As shown in FIGURE 2, the bight 52 is disposed slightly below the cover 31, and the inlet 50 is spaced a preselected distance below the bight 52 to provide an expansion space 53 in tank 11 at the top of chamber 12. As shown in FIGURE 2, the inlet tube 14 is provided with a vent opening 54 spaced below cover 31 to communicate with the expansion space 53 above the level of the siphon inlet 50. As will be described more fully hereinafter, the vent opening 54 provides an improved control of the pour-through liquid flow by controlling in a new and improved manner the pressure conditions within the chamber 12 of the tank 11 during the pour-through operation.

As indicated briefly above, the discharge conduit 16 is provided with a vent for further improved control of the liquid flow. More specifically, as shown in FIGURE 2, a T-connection 55 is provided in the duct 16 adjacent the outlet end 18 and a vent tube 56 extends upwardly therefrom through a sealing bushing 57 in the cover 31 to have an upper end 58 open-to-atmosphere in the space 46. The upper end 58 of the vent tube 56 is preferably above the normal maximum level of liquid in the receptacle 15, and, as shown in FIGURE 2, may be disposed at a level at least as high as the top 59 of the receptacle 15.

The operation of the liquid heater 10 may be best understood from successive considerations of FIGURES 2 through 5. Thus, at the completion of a pour-through operation, the delivery of the hot liquid downwardly through duct 16 and outwardly through the spray head 19 is terminated by the dropping of the liquid level to slightly below the siphon inlet 50. The liquid in the duct 16 continues to flow outwardly through the spray head as does the liquid in the vent duct 56 so as to effectively completely drain the ducts 16 and 56 at this time.

It has been found that in such a pass-through heater utilizing a spray cap, such as spray cap 19, having a plurality of small diameter spray openings 19*a*, there is a tendency for some liquid to remain on the inside of the cap and thereby block the final flow of liquid downwardly therethrough where the discharge conduit communicates with the atmosphere only through the inlet 50. The vent tube 56 has been found to eliminate this problem by placing the duct 16 at atmospheric pressure at the end of the discharge operation notwithstanding a reclosing of the inlet 50 by a return of the liquid level back to the level of the inlet 50 which has been found to occur very quickly after the siphon is broken by the exposure of the inlet 50 to the atmosphere in space 53.

When it is desired to obtain a subsequent quantity of hot liquid from the heater 10, the user merely pours into the receptacle 15 a quantity of cold liquid corresponding to the quantity of hot liquid desired. Assuming that the previously delivered cold liquid has now been heated by the heater 13, the level of the liquid L will have risen from the level L_1 corresponding to the level of the inlet 50 to an upper level L_2 closely adjacent the bight portion 52 of the gooseneck 17. Thus, delivery of the cold liquid into the receptacle 15 causes the cold liquid to flow downwardly through the duct 14 into the lower portion of the tank chamber 12 and thereby raise the level of the liquid in the tank to at least the level of the gooseneck 52 whereupon hot liquid at the top of the tank is caused to flow through the gooseneck 52, downwardly through the discharge conduit 16 and outwardly through the spray head 19, as shown in FIGURE 4. At the same time, the back pressure caused by the spray head 19 causes the liquid to rise in the vent tube 56 to approximately the level of the cold liquid in the receptacle 15. The inflow of the cold liquid from receptacle 15 causes the level of the liquid in chamber 12 to rise to the level of the inlet opening 54. However, the air in the expansion space 53 above the inlet opening 54 is effectively trapped therein and is compressed by the liquid L. Thus, the liquid rises in the gooseneck 17 to above the level L_3 of the liquid in space 53, as shown in FIGURE 4, causing an outflow of the hot liquid more quickly than where the level of the liquid in space 53 must rise also to the level of the bight 52 as when the top of the expansion chamber 53 is vented to the atmosphere at all times. The cold liquid flowing downwardly through duct 14 at least partially blocks the opening 54 during the inflow of the cold liquid into the tank to permit the expansion space 53 to become under above-atmospheric pressure during the inflow of the cold liquid therepast. When, however, the cold liquid is drained from the receptacle 15, as shown in FIGURE 5, and sufficient hot liquid is passed through the outlet duct 16 to lower the level of the liquid in the tank to a level such as level L_4 below the level of the opening 54, the expansion space 53 is placed in direct communication with the atmosphere, thereby venting the top of the chamber 12 and permitting the continuation of the siphoning action to withdraw the hot liquid from the tank until the

upper level thereof once again reaches the level L_1 at the inlet **50** to the siphon **17**, as shown in FIGURE 2, thereby to momentarily break the flow of liquid upwardly through siphon leg **49** and downwardly through duct **16**.

Thus, vent opening **54** in inlet duct **14** provides the highly desirable feature of maintaining the upper portion of the tank chamber **12** at above-atmospheric pressure during at least a substantial portion of the delivery of the cold liquid from the receptacle **15** into the tank, thereby effecting an expedited initiation of the delivering of hot liquid from the heater, while yet automatically causing the upper portion of the tank to be at atmospheric pressure upon completion of the delivery of cold liquid from the receptacle **15** to the tank and during the siphonning of the hot liquid from the tank comprising the final delivery of the hot liquid therefrom. The vent opening **54** may be arranged to permit the flow of some of the air in the expansion space **53** to pass outwardly therethrough and upwardly through the liquid in receptacle **15** during the initial introduction of the cold liquid into the tank from the receptacle. Preferably, the vent opening **54** is arranged so as to maintain the level of the liquid in the tank below the top of the opening during the pour-through operation, as illustrated in FIGURE 4. The level of the vent opening **54** may be, as desired, between the level of the gooseneck inlet **50** and the level of the bight **52** to provide the expedited flow initiation discussed above. However, if desired, the vent opening may be disposed above the level of the gooseneck while yet maintaining at least a portion of the space **12** at the top of the tank under above-atmospheric pressure during the pour-through operation thereby to obtain some expedited initiation of the delivery, as compared to the known devices wherein the top of the tank is vented to atmosphere so as to maintain the tank substantially at atmospheric pressure at all times.

The provision of the front accessible receptacle **15** permits the user to pour the cold liquid into the receptacle from a device, such as a decanter, and use the decanter for receiving the hot liquid delivered from the tank. This facilitated front filling of the receptacle is thus of further advantage where the improved facilitated initiation of liquid flow is obtained as in the above discussed pour-through structure.

Thus, my invention comprehends an improved liquid heater providing improved facility of operation in a novel and simple manner and at low cost. The improved functioning of the liquid heater **10** permits improved operation of apparatus, such as beverage brewing apparatus, in which the heater may form the hot liquid supply means.

I claim:

1. In a pass-through liquid heater having a tank provided with a top and a bottom and means for heating liquid delivered into the tank, means for controlling liquid flow therethrough, comprising: a delivery conduit having an upper end open to above said tank top for receiving cold liquid and extending downwardly through the tank top to adjacent said tank bottom for delivering the cold liquid into said tank adjacent said bottom, said conduit including an opening extending laterally therethrough providing communication between the interior of the conduit and the interior of the tank subjacent said tank top, said tank being closed at the top to define a pressure chamber subjacent said top; and a siphon outlet conduit having a downturned gooseneck upper portion including an inner leg within the tank having an inlet opening to the interior of the tank below the level of said delivery conduit opening, a discharge leg having an outlet opening to exteriorly of the tank below the level of said inlet for delivering hot liquid from the tank, and an uppermost passage portion extending to substantially above the level of said delivery conduit opening whereby said delivery conduit opening is disposed to permit compression of a substantial quantity of air in said pressure chamber above said opening during hot water flow from said tank.

2. The liquid heater of claim **1** wherein the level of said delivery conduit opening is closer to the level of said gooseneck inlet than it is to the tank top.

3. The liquid heater of claim **1** wherein said gooseneck of the outlet conduit includes an uppermost portion above the level of said delivery conduit opening and wherein the level of said delivery conduit opening is closer to the level of said gooseneck inlet than it is to the level of said uppermost portion of the gooseneck.

4. The liquid heater of claim **1** wherein said opening has a diameter of approximately .128 inch.

5. In a liquid heater having a tank, means for introducing cold liquid into the tank, and means for heating liquid in the tank, outlet means comprising: a siphon outlet conduit defining a discharge liquid flow passage, said conduit having a downturned gooseneck upper portion including an inlet leg opening to the interior of the tank and a discharge leg having an outlet opening to exteriorly of the tank at a level below the level of said inlet leg opening; means at said outlet for restricting liquid flow therethrough and means communicating with the discharge leg at a point between the level of said inlet leg opening and said level of said outlet and extending to upwardly of said tank for venting the discharge leg to atmosphere.

6. The liquid heater of claim **5** wherein said restricting means comprises a spray disc provided with a plurality of small apertures each having a cross-section smaller than the cross-section of said discharge flow passage.

7. The liquid heater of claim **5** wherein said restricting means comprises a metering orifice.

8. The liquid heater of claim **5** wherein the means for introducing cold liquid into the tank comprises a receptacle above the tank for receiving cold liquid and means for delivering the cold liquid from the receptacle into the tank, and said venting means comprises a vent duct opening to atmosphere at a level at least as high as the normal maximum level of liquid in said receptacle.

9. The liquid heater of claim **8** wherein said duct opens to atmosphere at a level at least as high as the level of the top of said receptacle.

10. The liquid heater of claim **5** wherein said discharge leg is disposed within said tank to open downwardly therethrough and said venting means comprises a duct within said tank and opening upwardly therethrough.

11. In a pour-through liquid heater having a tank, means in the tank for heating liquid therein, and means for conducting from the tank hot liquid as the result of the delivery of liquid into the tank, structure comprising: a cabinet enclosing said tank and having an upper portion defining a space above the level of said tank and a vertical wall portion having an opening therethrough opening horizontally to said space; a receptacle for receiving cold liquid; means for pivotally mounting said receptacle in a retracted position in said space and for selective swinging movement about an axis extending through said receptacle from said space through said opening to have a portion of the receptacle accessible exteriorly of the cabinet for receiving the cold liquid, said portion being displaced externally from above said liquid heating tank; and means for delivering cold liquid from said receptacle to the tank.

12. The liquid heater of claim **11** wherein said mounting means defines a pivot carried by the heating tank for swinging of said receptacle.

13. The liquid heater of claim **11** wherein said receptacle defines an outer wall substantially flush with said opening in said retracted position of the receptacle.

14. In a pour-through liquid heater having a tank, means in the tank for heating liquid therein, and means for conducting from the tank hot liquid as the result of the delivery of liquid into the tank, structure comprising: a cabinet enclosing said tank and having an upper portion defining a space above the level of said tank and a vertical wall portion having an opening therethrough opening horizontally to said space; a receptacle for re-

ceiving cold liquid; means for pivotally mounting said receptacle in a retracted position in said space and for selective swinging movement from said space through said opening to have at least a portion of the receptacle accessible exteriorly of the cabinet for receiving the cold liquid; and means for delivering cold liquid from said receptacle to the tank, said mounting means being carried on the upper end of said inlet means.

15. The liquid heater of claim **11** wherein said mounting means is arranged to permit disposition of the major portion of the receptacle outwardly of the cabinet in the accessible position.

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